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October 12, 2021
INDIANA UTILITY
REGULATORY COMMISSION

STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF INDIANA MICHIGAN POWER COMPANY, AN INDIANA CORPORATION, FOR AUTHORITY TO INCREASE ITS RATES AND CHARGES FOR ELECTRIC UTILITY SERVICE THROUGH A PHASE IN RATE ADJUSTMENT; AND FOR APPROVAL OF RELATED RELIEF INCLUDING: (1) REVISED DEPRECIATION RATES; (2) ACCOUNTING RELIEF; (3) INCLUSION OF CAPITAL INVESTMENT; (4) RATE ADJUSTMENT MECHANISM PROPOSALS; (5) CUSTOMER PROGRAMS: (6) WAIVER OR DECLINATION OF JURISDICTION WITH RESPECT TO CERTAIN RULES; AND (7) NEW SCHEDULES OF RATES, RULES AND REGULATIONS.	**))))))))))))))**	**CAUSE NO. 45576**

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

PUBLIC'S EXHIBIT NO. 4

TESTIMONY OF OUCC WITNESS DAVID J. GARRETT

RESOLVE UTILITY CONSULTING, INC

DEPRECIATION

OCTOBER 12, 2021

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STATE OF INDIANA

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OUCC PREFILED TESTIMONY

OF

DAVID J. GARRETT

PUBLIC'S EXHIBIT NO. 4

ON BEHALF OF THE

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

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I. INTRODUCTION

Q. State your name and occupation.

A. My name is David J. Garrett. I am a consultant specializing in public utility regulation. I am the managing member of Resolve Utility Consulting, PLLC. I focus my practice on the primary capital recovery mechanisms for public utility companies: cost of capital and depreciation.

Q. Summarize your educational background and professional experience.

A. I received a B.B.A. degree with a major in Finance, an M.B.A. degree, and a Juris Doctor degree from the University of Oklahoma. I worked in private legal practice for several years before accepting a position as assistant general counsel at the Oklahoma Corporation Commission in 2011, where I worked in the Office of General Counsel in regulatory proceedings. In 2012, I began working for the Public Utility Division as a regulatory analyst providing testimony in regulatory proceedings. In 2016 I formed Resolve Utility Consulting, PLLC, where I have represented various consumer groups and state agencies in utility regulatory proceedings, primarily in the areas of cost of capital and depreciation. I am a Certified Depreciation Professional with the Society of Depreciation Professionals. I am also a Certified Rate of Return Analyst with the Society of Utility and Regulatory Financial Analysts. A more complete description of my qualifications and regulatory experience is included in my curriculum vitae.[1]

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[1] Attachment DJG-2-1.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of the Indiana Office of Utility Consumer Counselor ("OUCC").

Q. Describe the scope and organization of your testimony.

A. My direct testimony addresses depreciation issues in response to the direct testimony of Company witness Jason A. Cash, who sponsors the depreciation study conducted for Indiana Michigan Power Company ("I&M" or the "Company").

Q. To the extent you do not address a specific item or adjustment, should that be construed to mean you agree with I&M's proposal?

A. No. Excluding any specific adjustments or amounts I&M proposes does not indicate my approval of those adjustments or amounts. Rather, the scope of my testimony is limited to the specific items addressed herein.

II. EXECUTIVE SUMMARY

Q. Summarize the key points of your testimony.

A. In the context of utility ratemaking, "depreciation" refers to a cost allocation system designed to measure the rate by which a utility may recover its capital investments in a systematic and rational manner over the average service life of the capital investment. I employed a depreciation system using actuarial and simulated plant analysis to statistically analyze the Company's depreciable assets and develop reasonable depreciation rates and annual accruals. The table below compares the proposed annual depreciation accruals in this case.[2]

Figure 1:
Depreciation Accrual Comparison by Plant Function

Plant Function	Plant Balance 12/31/2020	I&M Proposed Accrual	OUCC Proposed Accrual	**OUCC Accrual Adjustment**
Production	$ 4,712,321,073	$ 262,360,492	$ 261,704,090	$ (656,402)
Transmission	1,681,050,133	44,835,980	42,476,682	(2,359,298)
Distribution - IN	2,081,061,734	65,338,424	49,515,629	(15,822,795)
General	163,063,321	6,527,140	6,527,140	0
Total Plant Studied	$ 8,637,496,261	$ 379,062,036	$ 360,223,541	**$ (18,838,495)**

The original cost and accrual amounts shown in this table correspond to plant balances at December 31, 2020. As shown in this table, the OUCC's proposed depreciation accrual is $18.8 million less than the Company's proposed accrual.

Q. Summarize the primary factors driving OUCC's adjustment.

A. OUCC's total proposed depreciation adjustment comprises two key issues: (1) removing the contingency and escalation factors from the Company's proposed terminal net salvage rates; and (2) adjusting the Company's proposed service lives for several of its transmission and distribution accounts. The estimated impact of these issues on OUCC's proposed adjustment to the depreciation accrual are summarized in the table below.

[2] *See* Attachment DJG-2-2.

Figure 2:
Broad Issue Impacts

Issue	Impact	
1. Remove contingency and escalation factors	$0.7	million
2. Propose longer service lives for some T&D accounts	$18.1	million
Total	**$18.8**	**million**

A narrative summary of these issues is presented below:

1. <u>Remove Contingency Costs</u>

The Company's terminal net salvage costs are estimated through demolition studies for most of its generating units. The demolition studies include contingency costs to reflect uncertainties in future demolition estimates. However, contingency costs are unknown by definition, and therefore are not known and measurable and not appropriate to include in rates. Charging current ratepayers for speculative costs that may not even occur up to decades in the future is inherently problematic from a ratemaking perspective. Contingency costs add further expense to an already speculative future cost estimate. Although the dollar impacts of contingency costs in this particular case are relatively small, the Commission should reject the inclusion of contingency costs in the terminal net salvage estimates of generating units as a matter of ratemaking policy and principle.

3. <u>Remove Escalation Factor</u>

The Company's demolition cost estimates are based on present-day dollars. However, the Company escalated those cost estimates to the future retirement date of each generating unit by applying an annual cost inflation factor. The Company uses this escalated amount as the basis for current-day cost recovery. The problem with this approach is that current ratepayers are forced to pay for a future-value cost with present-day dollars. This violates basic time-value-of-money principles. If future, escalated costs are allowed, they should then be discounted back to present-day dollars by the Company's weighted average cost of capital. A similar approach is used to account for asset retirement obligations. However, it would be more straight-forward and reasonable to simply disallow the escalation factors and base the Company's demolition costs on present value.

3. Propose Longer Service Lives for Mass Property Accounts

> The majority of the Company's service life estimates for its transmission and distribution (or "mass property") accounts were based on the Simulated Plant Record Model. Simulated data is not as reliable as the actuarial data that is typically used to estimate service lives. Moreover, the metrics used to assess the value of the Company's simulated data show that the results of the simulated analysis are essentially valueless for several accounts. For these accounts, the Company has failed to present any evidence supporting its service life estimates. When a utility's data is not reliable for conducting service life analysis, it is necessary to compare the approved service lives of other utilities. A comparison of several of I&M's peers, including two of its sister companies, reveals that the Company's proposed service lives for several accounts are grossly understated. I propose several reasonable adjustments to these accounts to bring I&M's service life estimates closer to what is observed in the industry.

Each of these issues will be discussed in more detail in my testimony.

Q. Describe why it is important not to overestimate depreciation rates.

A. Under the rate-base rate of return model, the utility is allowed to recover the original cost of its prudent investments required to provide service. Depreciation systems are designed to allocate those costs in a systematic and rational manner – specifically, over the service lives of the utility's assets. If depreciation rates are overestimated (i.e., service lives are underestimated), it may unintentionally incent economic inefficiency. When an asset is fully depreciated and no longer in rate base, but still used by a utility, a utility may be incented to retire and replace the asset to increase rate base, even though the retired asset may not have reached the end of its economic useful life. If, on the other hand, an asset must be retired before it is fully depreciated, there are regulatory mechanisms that can ensure the utility fully recovers its prudent investment in the retired asset. Thus, in my opinion, it is preferable for regulators to ensure that assets are not depreciated before the end of their economic useful lives.

III. LEGAL STANDARDS

Q. Discuss the standard by which regulated utilities are allowed to recover depreciation expense.

A. In *Lindheimer v. Illinois Bell Telephone Co.*, the U.S. Supreme Court stated that "depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy, and obsolescence."[3] The *Lindheimer* Court also recognized that the original cost of plant assets, rather than present value or some other measure, is the proper basis for calculating depreciation expense.[4] Moreover, the *Lindheimer* Court found:

> [T]he company has the burden of making a convincing showing that the amounts it has charged to operating expenses for depreciation have not been excessive. That burden is not sustained by proof that its general accounting system has been correct. The calculations are mathematical, but the predictions underlying them are essentially matters of opinion.[5]

Thus, the Commission must ultimately determine if I&M has met its burden of proof by making a convincing showing that its proposed depreciation rates are not excessive.

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[3] *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 167 (1934).

[4] *Id*. (Referring to the straight-line method, the *Lindheimer* Court stated that "[a]ccording to the principle of this accounting practice, the loss is computed upon the actual cost of the property as entered upon the books, less the expected salvage, and the amount charged each year is one year's pro rata share of the total amount."). The original cost standard was reaffirmed by the Court in *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 606 (1944). The *Hope* Court stated: "Moreover, this Court recognized in [*Lindheimer*], supra, the propriety of basing annual depreciation on cost. By such a procedure the utility is made whole and the integrity of its investment maintained. No more is required."

[5] *Id*. at 169.

Q. Should depreciation represent an allocated cost of capital to operation, rather than a mechanism to determine loss of value?

A. Yes. While the *Lindheimer* case and other early literature recognized depreciation as a necessary expense, the language indicated that depreciation was primarily a mechanism to determine loss of value.[6] Adoption of this "value concept" requires annual appraisals of extensive utility plant and is thus not practical in this context. Rather, the "cost allocation concept" recognizes that depreciation is a cost of providing service, and that in addition to receiving a "return on" invested capital through the allowed rate of return, a utility should also receive a "return of" its invested capital in the form of recovered depreciation expense. The cost allocation concept also satisfies several fundamental accounting principles, including verifiability, neutrality, and the matching principle.[7] The definition of "depreciation accounting" published by the American Institute of Certified Public Accountants ("AICPA") properly reflects the cost allocation concept:

> Depreciation accounting is a system of accounting that aims to distribute cost or other basic value of tangible capital assets, less salvage (if any), over the estimated useful life of the unit (which may be a group of assets) in a systematic and rational manner. It is a process of allocation, not of valuation.[8]

Thus, the concept of depreciation as "the allocation of cost has proven to be the most useful and most widely used concept."[9]

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[6] *See* Frank K. Wolf & W. Chester Fitch, *Depreciation Systems* 71 (Iowa State University Press 1994).

[7] National Association of Regulatory Utility Commissioners, *Public Utility Depreciation Practices* 12 (NARUC 1996).

[8] American Institute of Accountants, *Accounting Terminology Bulletins Number 1: Review and Résumé* 25 (American Institute of Accountants 1953).

[9] Wolf *supra* n. 9, at 73.

IV. ANALYTIC METHODS

Q. Discuss the definition and general purpose of a depreciation system, as well as the specific depreciation system you employed for this project.

A. The legal standards set forth above do not mandate a specific procedure for conducting depreciation analysis. These standards, however, direct that analysts use a system for estimating depreciation rates that will result in the "systematic and rational" allocation of capital recovery for the utility. Over the years, analysts have developed "depreciation systems" designed to analyze grouped property in accordance with this standard. A depreciation system may be defined by several primary parameters: 1) a method of allocation; 2) a procedure for applying the method of allocation; 3) a technique of applying the depreciation rate; and 4) a model for analyzing the characteristics of vintage property groups.[10] In this case, I used the straight-line method, the average life procedure, the remaining life technique, and the broad group model; this system would be denoted as an "SL-AL-RL-BG" system. This depreciation system conforms to the legal standards set forth above and is commonly used by depreciation analysts in regulatory proceedings. I provide a more detailed discussion of depreciation system parameters, theories, and equations in Appendix A.

Q. Are you and Mr. Cash essentially using the same depreciation system to conduct your analyses?

A. Yes. Mr. Cash and I are essentially using the same depreciation system. Thus, the difference in our positions stems from our different opinions regarding production net

[10] *See* Wolf *supra* n. 7, at 70, 140.

salvage rates, interim retirements, and mass property service life estimates. It is also important to note that unlike some other Indiana utilities that have proposed depreciation rates using the Equal Life Group ("ELG") method, I&M is proposing depreciation rates under the Average Life Group ("ALG") method. As discussed in my testimonies filed in Cause Nos. 45159[11] and 45039,[12] I believe the ALG method results in more fair and reasonable depreciation rates when compared to the ELG method. In short, the ELG method generally results in higher depreciation rates charged to customers in the earlier years of vintage group's life and lower depreciation rates in later years. Although depreciation rates developed under the ELG method can still be applied in a "straight-line" application, it effectively results in an accelerated method of expense recovery because depreciation rates are not adjusted every year. Thus, the more practical and reasonable approach in a ratemaking context (i.e., where depreciation rates are not adjusted every year) is to approve depreciation rates developed under the ALG method. Thus, while I have several disagreements with Mr. Cash's opinions on service life and net salvage in this case, I agree with his use of the ALG method.

Q. Please describe the Company's depreciable assets in this case.

A. The Company's depreciable assets can be divided into two main groups: life span property (i.e., production plant) and mass property (i.e., transmission and distribution plant). I will discuss my analysis of the accounts in both types of property below.

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[11] *Petition of N. Ind. Pub. Serv. Co.*, Cause No. 45159, Final Order (Ind. Util. Regulatory Comm'n Dec. 27, 2018).

[12] *Petition of Citizens Gas*, Cause No. 45039, Final Order (Ind. Util. Regulatory Comm'n Dec. 4, 2019).

V. LIFE SPAN PROPERTY ANALYSIS

A. Introduction

Q. Describe life span property.

A. "Life span" property accounts usually consist of property within a production plant. The assets within a production plant will be retired concurrently at the time the plant is retired, regardless of their individual ages or remaining economic lives. For example, a production plant will contain property from several accounts, such as structures, fuel holders, and generators. When the plant is ultimately retired, all of the property associated with the plant will be retired together, regardless of the age of each individual unit. Analysts often use the analogy of a car to explain the treatment of life span property. Throughout the life of a car, the owner will retire and replace various components, such as tires, belts, and brakes. When the car reaches the end of its useful life and is finally retired, all of the car's individual components are retired together. Some of the components may still have some useful life remaining, but they are nonetheless retired along with the car. Thus, the various accounts of life span property are scheduled to retire concurrently as of the production unit's probable retirement date.

B. Terminal Net Salvage and Demolition Costs

Q. Describe the meaning of terminal net salvage.

A. When a production plant reaches the end of its useful life, a utility may decide to decommission the plant. In that case, the utility may sell some of the remaining assets. The proceeds from this transaction are called "gross salvage." The corresponding expense associated with demolishing plant is called "cost of removal." The term "net salvage" equates to gross salvage less the cost of removal. When net salvage refers to production plants, it is often called "terminal net salvage," because the transaction will occur at the end of the plant's life.

Q. Describe how electric utilities typically support terminal net salvage recovery for production assets.

A. Typically, when a utility is requesting the recovery of a substantial amount of terminal net salvage costs, it supports those costs with site-specific demolition studies.

Q. Did I&M provide demolition studies for its production units in this case?

A. Yes. The Company provided demolition studies conducted by Brandenberg (for steam production) and Sargent & Lundy (for hydraulic production) in support of its proposed demolition costs.[13]

Q. What is the total amount of present-value terminal net salvage included in the Company's proposed depreciation rates?

A. I&M is proposing more than $9 million of present-value terminal net salvage to be included in its depreciation rates.[14]

Q. Did you identify any unreasonable assumptions included in the Company's proposed terminal net salvage costs?

A. Yes. The Company's proposed terminal net salvage costs include contingency costs. In addition, the Company is proposing to charge current customers with inflated future costs

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[13] *See* I&M Attachments JAC-2 and JAC-3.

[14] *Id.*; *see also* Attachment DJG-2-6.

by escalating the present-value demolition cost estimates by an annual inflation factor. These two issues are further discussed below.

1. <u>Contingency Costs</u>

Q. Do the Company's demolition studies include contingency factors that further inflate cost estimates?

A. Yes. The demolition studies have stated contingency factors of 15%.[15] However, the contingency costs effectively increase the base estimated demolition costs by more than 40% for some generating facilities.[16]

Q. What is I&M's argument for including contingency costs?

A. Mr. Cash correctly acknowledges that contingency costs are "intended to cover unknowns."[17] However, this argument would be better support for the <u>exclusion</u> of contingency costs, especially in the context of ratemaking. Under basic ratemaking principles, current customers should not be charged for future costs occurring decades into the future that are "unknown" by definition. In other words, even if the plant demolitions were to occur tomorrow, the contingency costs would still be unknown by definition. The fact that contingency costs are to occur up to several decades from now exacerbates this problem, especially from a ratemaking perspective.

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[15] *See* I&M Attachment JAC-3.

[16] *See* Attachment DJG-2-6.

[17] Direct Testimony of Jason A. Cash, p. 9, line 16.

Q. Could the same argument in support of increased contingency costs be used to support decreased contingency costs?

A. Yes. If one were to approach this issue objectively, the same arguments used in support of increased contingency costs could be used to support decreased contingency costs. In other words, if a future cost is unknown (which demolition costs are), then it would be just as fair to ratepayers to decrease such cost estimates to account for "unknown" factors that might reduce costs, as it would be to shareholders to increase such costs. However, I think the most fair and reasonable approach is to disallow contingency factors in either direction.

Q. Do your proposed net salvage rates exclude the Company's proposed contingency factors?

A. Yes, for the reasons discussed above, my proposed terminal net salvage rates exclude the contingency costs proposed in the Company's demolition studies.[18]

2. Escalation Factor

Q. Describe the specific problems with the escalation factor the Company applied to its demolition cost estimates.

A. The Company's demolition studies estimated costs in present value. However, Mr. Cash applied an annual inflation rate of 2.2% to the estimated demolition costs. It is not appropriate for the Company to escalate its demolition cost estimates. First, it is not reasonable to escalate a cost that already is not known and measurable. Moreover, because the demolition cost estimates are based on the escalated amount, current ratepayers should not be charged for a future cost that has not been discounted to present value. The concept

[18] *See* Attachment DJG 2-6.

of the time value of money is a cornerstone of finance and valuation. For example, the Gordon Growth Model (or DCF Model) is one of the most widely used valuation models. This model applies a growth rate to a company's dividends many years into the future. However, that dividend stream is then discounted back to the current year by a discount rate in order to arrive at the present value of an asset. In contrast to this approach, the Company has escalated the present value of its demolition costs decades into the future and is essentially asking current ratepayers to pay the future value of a cost with present-day dollars. This arrangement ignores the time value of money principle and is inappropriate for that reason.

Q. Do the Company's asset retirement obligations discount future costs to present value?

A. Yes. The accounting for asset retirement obligations ("ARO") is governed by Statement of Financial Account Standards ("SFAS") 143. Under SFAS 143, estimated future costs that meet the requirements for an ARO are estimated at present value, then escalated to a future date when the cost is projected to be incurred. So far, this resembles the approach taken by the Company regarding its demolition cost estimates. However, under SFAS 143, the costs are then discounted back to present value using a discount rate – such as the weighted average cost of capital. Unlike the SFAS 143 approach, the Company did not discount its future demolition costs to present value. This means the Company expects current ratepayers to pay their present-value dollars for a future value cost. This approach violates the time-value-of-money principle and is at odds with the approach dictated by SFAS 143 regarding AROs.

Q. Do your proposed net salvage rates exclude the Company's proposed escalation factor?

A. Yes, for the reasons discussed above, my proposed terminal net salvage rates exclude the annual escalation factor Mr. Cash applied to the estimated demolition costs.[19]

Q. Have other jurisdictions consistently rejected contingency and escalation factors in production net salvage rates?

A. Yes. The Oklahoma Corporation Commission has rejected the use of contingency and escalation factors in production net salvage rates. For example, in the 2015 rate case for Public Service Company of Oklahoma ("PSO"), a sister company of I&M, the company proposed the inclusion of escalation and contingency factors in calculating PSO's terminal net salvage. Like I&M, PSO hired Sargent & Lundy ("S&L") to conduct its demolition studies. In rejecting PSO's proposed escalation factor, the ALJ found as follows:

> The ALJ adopts Staff witness Garrett's recommendation that the Commission should deny the proposed escalation of demolition costs in this case because (1) the escalated costs do not appear to be calculated in the same manner as other calculations; (2) the Company did not offer any testimony in support of the escalation factor; (3) an escalation factor that does not consider any improvements in technology or economic efficiencies likely overstates future costs; (4) it is inappropriate to apply an escalation factor to demolition costs that are likely overstated; (5) asking ratepayers to pay for future costs that may not occur, are not known and measurable changes within the meaning of 17 O.S. § 284; and (6) the Commission has not approved escalated demolition costs in previous cases.[20]

Likewise, in rejecting PSO's proposed contingency factors, the ALJ found as follows:

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[19] *See* Attachment DJG-2-6 (terminal net salvage costs are not escalated to future retirement dates).

[20] *Re Pub. Serv. Co. Okla.*, Cause No. PUD 201500208, Report and Recommendation of the Administrative Law Judge p. 164, (Okla. Corp. Comm'n May 31, 2016).

> In its demolition cost study, S&L applied a 15% contingency factor to its cost estimates, and a negative 15% contingency factor to its scrap metal value estimates. The Company provides little justification for this contingency factor other than the plants might experience uncertainties and unplanned occurrences. <u>This reasoning fails to consider the fact that certain occurrences could reduce estimated costs</u>.[21]

Based on the same reasoning, the Commission should also reject I&M's proposed contingency and escalation factors in this case.

VI. <u>MASS PROPERTY ANALYSIS</u>

Q. Describe mass property.

A. Unlike life span property accounts, "mass" property accounts usually contain a large number of small units that will not be retired concurrently. For example, poles, conductors, transformers, and other transmission and distribution plant are usually classified as mass property. Estimating the service life of any single unit contained in a mass account would not require any actuarial analysis or curve-fitting techniques. Since we must develop a single rate for an entire group of assets, however, actuarial analysis is required to calculate the average remaining life of the group.

Q. Describe the methodology used to estimate the service lives of grouped depreciable assets.

A. The study of retirement patterns of industrial property is derived from the same actuarial process used to study human mortality. Just as actuarial analysts study historical human mortality data to predict how long a group of people will live, depreciation analysts study

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[21] *Id*. (emphasis added).

historical plant data to estimate the average lives of property groups. The most common actuarial method used by depreciation analysts is called the "retirement rate method." In the retirement rate method, original property data, including additions, retirements, transfers, and other transactions, are organized by vintage and transaction year.[22] The retirement rate method is ultimately used to develop an "observed life table," ("OLT") which shows the percentage of property surviving at each age interval. This pattern of property retirement is described as a "survivor curve." The survivor curve derived from the observed life table, however, must be fitted and smoothed with a complete curve in order to determine the ultimate average life of the group.[23] The most widely used survivor curves for this curve fitting process were developed at Iowa State University in the early 1900s and are commonly known as the "Iowa curves."[24] A more detailed explanation of how the Iowa curves are used in the actuarial analysis of depreciable property is set forth in Appendices B and C.

Q. Describe the process you used to estimate the service lives for the Company's depreciable accounts in this case.

A. To develop service life estimates for the Company's accounts, I obtained and analyzed the Company's actuarial and simulated plant data. I used the Simulated Plant Record ("SPR") method to analyze the same mass property accounts analyzed by Mr. Cash under the SPR

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[22] The "vintage" year refers to the year that a group of property was placed in service (aka "placement" year). The "transaction" year refers to the accounting year in which a property transaction occurred, such as an addition, retirement, or transfer (aka "experience" year).

[23] *See* Appendix C for a more detailed discussion of the actuarial analysis used to determine the average lives of grouped industrial property.

[24] *See* Appendix B for a more detailed discussion of the Iowa curves.

method. Likewise, I used actuarial analysis to analyze the same mass property accounts analyzed by Mr. Cash under the actuarial method. Thus, the difference in proposed service lives in this case are not due to the use of different analytical methods with regard to SPR and actuarial analysis.

A. <u>Actuarial Analysis</u>

Q. Please describe the actuarial analysis process.

A. I used the Company's historical property data and created an observed life table ("OLT") for each applicable account. The data points on the OLT can be plotted to form a curve (the "OLT curve"). The OLT curve is not a theoretical curve, rather, it is actual observed data from the Company's records that indicate the rate of retirement for each property group. An OLT curve by itself, however, is rarely a smooth curve, and is often not a "complete" curve (i.e., it does not end at zero percent surviving). To calculate average life (the area under a curve), a complete survivor curve is required. The Iowa curves are empirically-derived curves based on the extensive studies of the actual mortality patterns of many different types of industrial property. The curve-fitting process involves selecting the best Iowa curve to fit the OLT curve. This can be accomplished through a combination of visual and mathematical curve-fitting techniques, as well as professional judgment. The first step of my approach to curve-fitting involves visually inspecting the OLT curve for any irregularities. For example, if the "tail" end of the curve is erratic and shows a sharp decline over a short period of time, it may indicate that this portion of the data is less reliable, as further discussed below. After visually inspecting the OLT curve, I use a mathematical curve-fitting technique which essentially involves measuring the distance between the OLT curve and the selected Iowa curve in order to get an objective assessment of how well the curve fits. After selecting an Iowa curve, I observe the OLT curve along with the Iowa curve on the same graph to determine how well the curve fits. I may repeat this process several times for any given account to ensure that the most reasonable Iowa curve is selected.

Q. Are you recommending adjustments to any of the Company's accounts based on your actuarial analysis?

A. Yes. I recommend adjusting I&M's proposed service lives for two accounts based on actuarial analysis. Those accounts are discussed below.

1. <u>Account 367 – Underground Conductor</u>

Q. Describe your service life estimate for this account and compare it with the Company's estimate.

A. The observed survivor curve (OLT curve) derived from the Company's data for this account is presented in the graph below. The graph also shows the Iowa curves Mr. Cash and I selected to represent the average remaining life of the assets in this account. For this account, Mr. Cash selected the R2-54 Iowa curve, and I selected the R1-60 Iowa curve. Both of these curves are shown in the graph below along with the OLT curve.[25]

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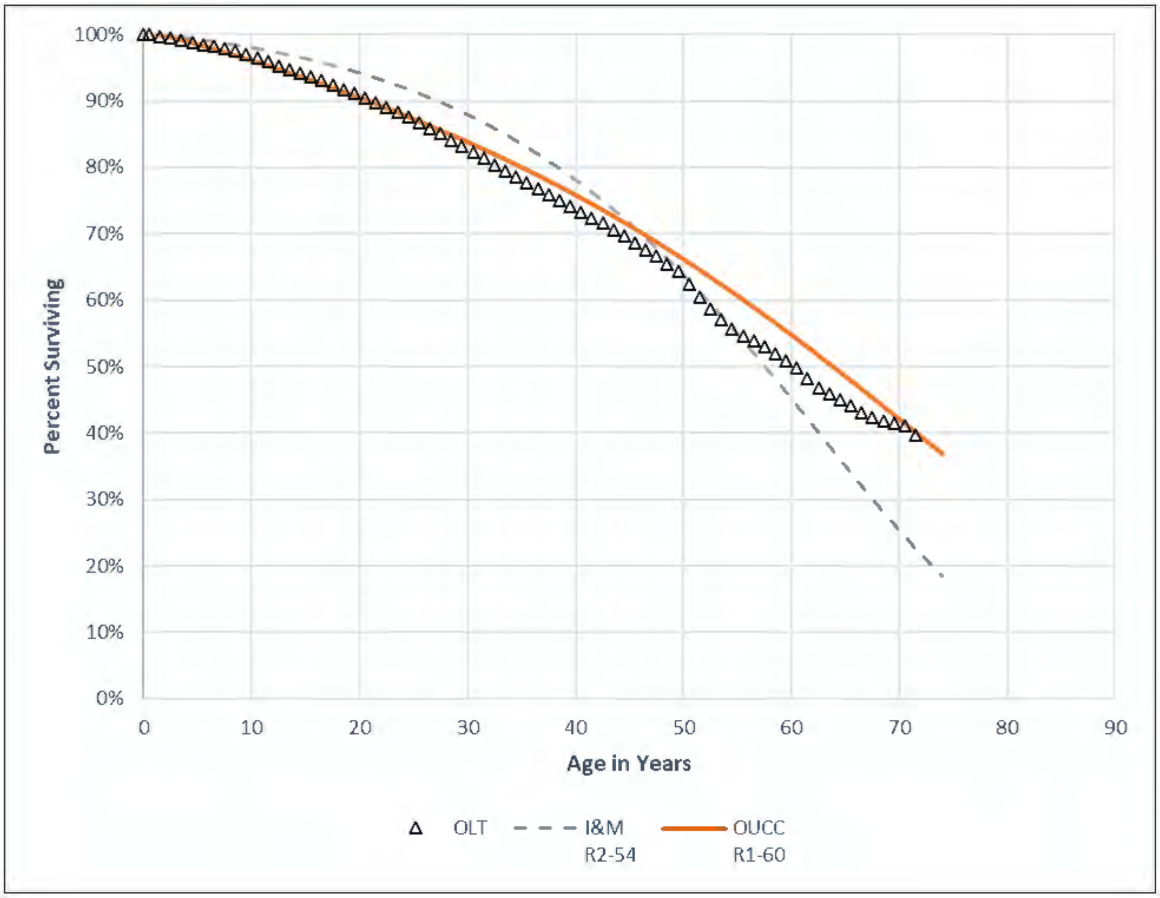
[25] Attachment DJG-2-12.

Figure 3:
Account 367 – Underground Conductor

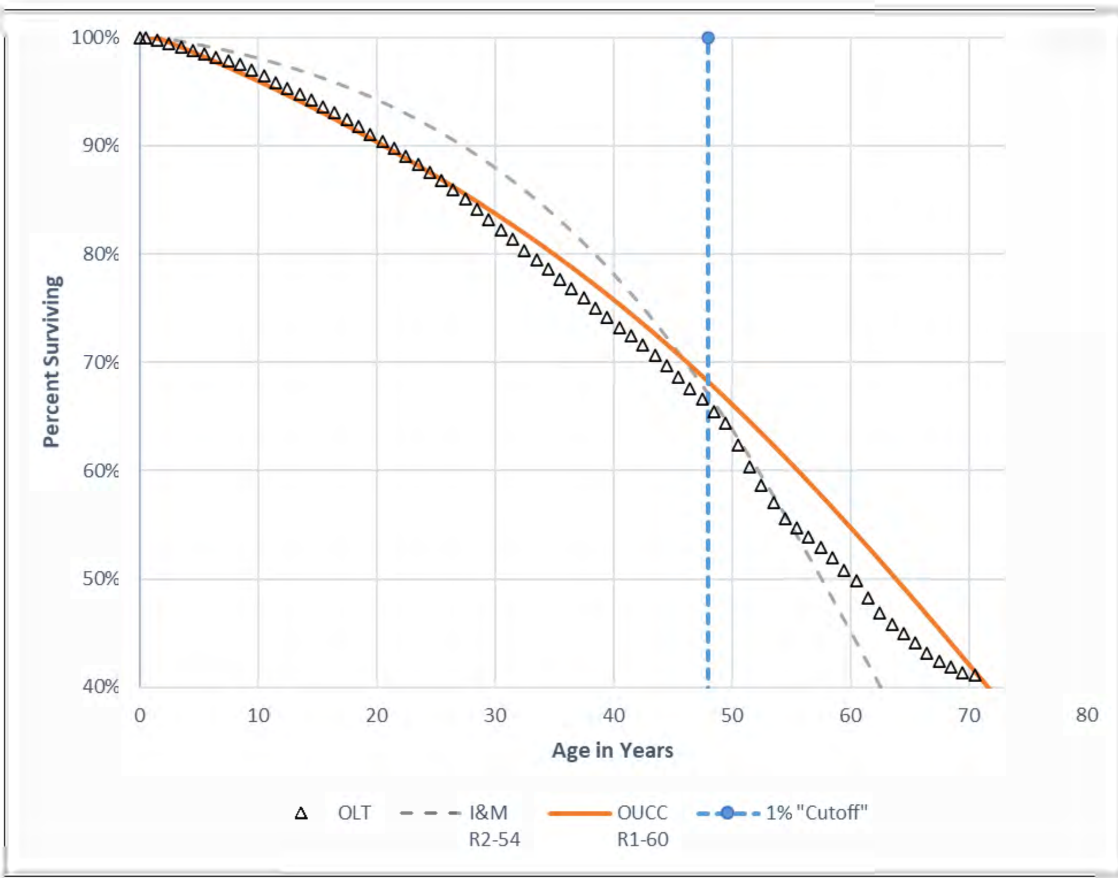


The OLT curve for this account is fairly well-suited for conventional Iowa curve-fitting techniques because it is relatively smooth and displays a typical retirement pattern for utility property. As shown in the graph, the Iowa curve selected by Mr. Cash is not as flat as the pattern derived from the historical data in the OLT curve. The lower-modal R1 curve I selected, along with an average life that is four years longer, provide a better fit to the observed data.

Q. Are all of the data points on this graph statistically relevant?

A. No. As discussed above, it can be beneficial to consider the most relevant portions of the OLT curve based on the beginning dollars exposed to retirement in each account in order to focus on more statistically significant data. While it is not an authoritative standard, I typically consider data points occurring approximately after the data point corresponding to 1% of the beginning exposures in a particular account to be statistically irrelevant. The graph below shows where this 1% cutoff or "truncation" would be for this account.

Figure 4:
Account 367 – Underground Conductor (truncated)



The data points occurring to the right of the dotted blue line are less relevant for statistical analyses. Even when the truncated OLT curve is considered, the R1-60 Iowa curve still provides a better fit to the historical data.

Q. Does your selected Iowa curve provide a better mathematical fit to the relevant portion of the OLT curve?

A. Yes. While visual curve-fitting techniques can help an analyst identify the most statistically relevant portions of the OLT curve for this account, mathematical curve-fitting techniques can help us determine which of the two Iowa curves provides the better fit (especially in cases where it is not obvious from a visual standpoint which curve provides the better fit). Mathematical curve-fitting essentially involves measuring the "distance" between the OLT curve and the selected Iowa curve. The best fitting curve from a mathematical standpoint is the one that minimizes the distance between the OLT curve and the Iowa curve, thus providing the closest fit. The distance between the curves is calculated using the "sum-of-squared differences" ("SSD") technique.

In this account, the total SSD, or distance between the Company's curve and the OLT curve is 0.2964, while the total SSD between the R1-60 curve and the OLT curve is only 0.0188.[26] Thus, the R1-56 curve is a better mathematical fit to the historical data, and it provides a more reasonable service life estimate and depreciation rate for this account in my opinion. This is true regardless of whether the entire OLT curve or only the truncated OLT curve is considered.

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[26] Attachment DJG-2-7.

2. Account 370 – Meters

Q. Describe the Company's depreciation rate proposal for Account 370 – Meters.

A. For this account, Mr. Cash did not calculate his proposed depreciation rate in the same manner as the other mass property accounts. The Company decided to transition to AMI meters over the next four years and to retire the meters currently installed over the same time period.[27] According to Mr. Cash, he utilized a depreciation rate in the current depreciation study to reflect the retirement of the meters that are currently installed and the installation of new AMI meters.[28] The resulting depreciation rate the Company proposes for Account 370 is 10.08%.[29]

Q. Do you agree with the Company's proposal to accelerate the cost of recovery for Account 370?

A. No. There is no reason to calculate the depreciation rate for Account 370 in a different manner than the Company's other mass property accounts. When depreciation rates are developed for mass property accounts (as they are in this case), it ensures that the Company will recover all of its investment over the average remaining life calculated for each account. Some assets will retire sooner than the average, and some assets will retire later than the average. I disagree with the decision to select particular assets in one account and apply a special, accelerated depreciation rate for those assets. This decision has the result

[27] Cash, p. 15, lines 19-25.

[28] *Id*.

[29] *Id*. at p. 16, lines 5-8.

of increasing the revenue requirement and cash flow for the Company, but it is neither necessary nor reasonable.

Q. How do you recommend the depreciation rate be determined for Account 370?

A. I recommend the depreciation rate for Account 370 be determined and calculated in a manner that is the same for the Company's other transmission and distribution accounts, as demonstrated in the following analyses. For Account 370, as discussed above, Mr. Cash did not select an Iowa curve to apply to the historical retirement pattern observed in this account for the purpose of calculating a conventional remaining life depreciation rate. Instead, he selected an average life of 15 years for AMI meters after the meters are installed, as illustrated by an SQ-15 Iowa curve in the graph below.[30] For this account, I selected the L0-16 Iowa curve to calculate the remaining life and depreciation rate for this account (in the same manner at the Company's other mass property accounts). These Iowa curves are illustrated in the graph below along with the OLT curve.[31]

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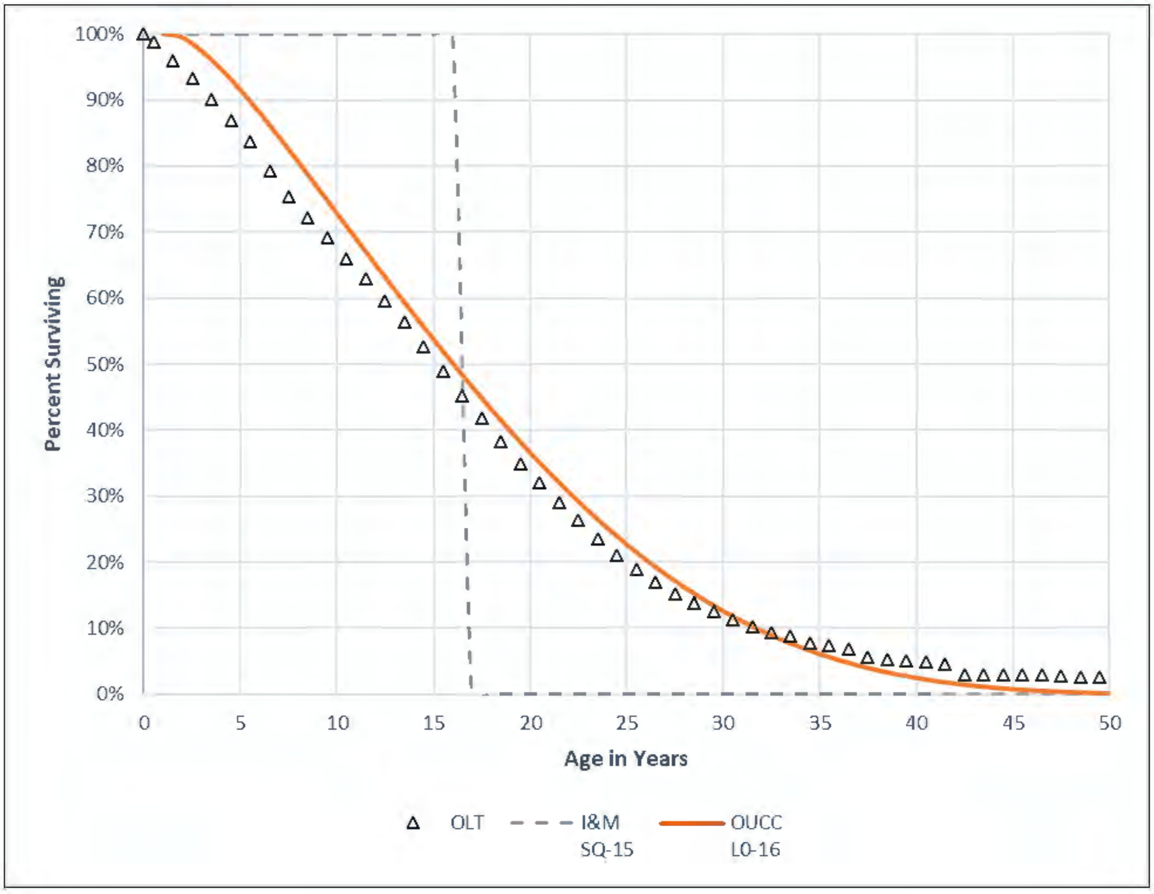
[30] *Id*. at p. 16, lines 19-22.

[31] Attachment DJG-2-8.

Figure 5:
Account 370 – Meters



As shown in the graph, the L0-16 curve I selected provides a very good fit to the observed data in this account. When the L0-16 curve is applied to plant balance in this account as of the depreciation study date, it results in a remaining life of 11.35 years and a depreciation rate of 5.87%.[32] Not surprisingly, the SSD for this account, only 0.0186, is relatively low because of how well the L0-16 curve fits to the OLT curve. Applying the L0-16 curve to

[32] Attachment DJG-2-5.

this account results in an adjustment of $3.2 million to the Company's proposed depreciation accrual.[33]

B. Simulated Plant Record Analysis

Q. Describe the Simulated Plant Record method of analysis.

A. As discussed above, when aged data is not available, we must "simulate" the actuarial data required for remaining life analysis. For most of the Company's transmission and distribution accounts, both Mr. Cash and I conducted an analysis using the simulated plant record ("SPR") model, because the Company does not keep aged data for these accounts. The SPR method involves analyzing the Company's unaged data by choosing an Iowa curve that best simulates that actual year-end account balances in the account.[34]

Q. Compared with results obtained through actuarial analysis, are results obtained through SPR analysis less reliable in general?

A. Yes. Ideally, a utility would keep aged data that is suitable to be analyzed under actuarial analysis and conventional Iowa curve fitting techniques. With aged data, the ages of the assets retired are known. In contrast, with unaged data, the ages of the assets retired are now known and thus must be "simulated" through the SPR method.

Q. Describe the metrics used to assess the fit of a selected Iowa curve in the SPR model.

A. There are two primary metrics used to measure the fit of the Iowa curve selected to describe an SPR account. The first is the "conformance index" ("CI"). The CI is the average

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[33] Attachment DJG-2-4.

[34] A detailed discussion of the SPR method is included in Appendix D.

observed plant balance for the tested years, divided by the square root of the average sum of squared differences between the simulated and actual balances plant balances.[35] A higher CI indicates a better fit. Alex Bauhan, who developed the CI, also proposed a scale for measuring the value of the CI, as follows:

Figure 6:
Conformance Index Scale

CI	Value
> 75	Excellent
50 – 75	Good
25 – 50	Fair
< 25	Poor

The second metric used to assess the accuracy of an Iowa curve chosen for SPR analysis is called the "retirement experience index" ("REI"), which was also proposed by Bauhan. The REI measures the length of retirement experience in an account. A greater retirement experience indicates more reliability in the analytical results for an account. Bauhan proposed a similar scale for the REI, as follows:

Figure 7:
Retirement Experience Index Scale

REI	Value
> 75%	Excellent
50% – 75%	Good
33% – 50%	Fair
17% – 33%	Poor
0% – 17%	Valueless

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[35] Bauhan, A. E., "Life Analysis of Utility Plant for Depreciation Accounting Purposes by the Simulated Plant Record Method," 1947, Appendix of the EEl, 1952.

According to Bauhan, "[i]n order for a life determination to be considered entirely satisfactory, it should be required that both the retirements experience index and the conformance index be 'Good' or better."[36]

Q. Do the Iowa curves selected by Mr. Cash provide "Good" or better results based on the CI and REI scales for all of the Company's accounts analyzed under SPR analysis?

A. No. For some of the Company's accounts, there is no Iowa curve available that produces a result of at least "Good" under both scales. This highlights the relative unreliability of the Company's simulated, unaged historical data for these accounts, and why it can be helpful to also consider the service life estimates approved for other utilities that were based on actuarial analyses of superior, aged data.

Q. Please summarize the general differences between your service life estimates and the Company's service life estimates for these accounts.

A. In this case, I am proposing service life adjustments to seven of the Company's transmission and distribution accounts based on SPR analysis. In my opinion, Mr. Cash's proposed service lives for these accounts are too short and thus result in excessive depreciation accruals and expense. My opinions are based in part on the Company's historical data, but because the Company's data is relatively unreliable, I also considered the approved service lives for the transmission and distribution assets for electric utilities that keep aged data for these accounts. As discussed below, the service lives estimated by

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[36] *Id*. (emphasis added).

Mr. Cash for some accounts are notably shorter than those approved for these other utilities. For the seven accounts discussed in this section, the Company has failed to meet its burden to show that its proposed depreciation rates for these accounts is not excessive.

Q. Please summarize the approved service lives of other utilities you considered when developing your recommendations in this case.

A. As discussed above, when the plant data provided by a utility is generally unreliable, it can be instructive to consider the approved service lives of other utilities for the same accounts to develop an objective basis for estimating the service life of an asset or group of assets. In addition to relying upon my general experience in depreciation analysis, I also considered the specific approved service lives for three other utilities – SWEPCO, Oklahoma Gas and Electric Company ("OG&E"), and PSO. SWEPCO and PSO are sister companies of I&M. I also chose these companies for a peer comparison because I conducted depreciation analysis and filed testimony in their most recent rate cases; thus, I am familiar with the actuarial data upon which the approved service lives were based. The following table presents the service lives of each mass property account I propose adjustments to that were analyzed under the SPR method.[37]

[37] *See also* Attachment DJG-2-7.

Figure 8:
Peer Group Comparison

			Peer Group					
		[1]	[2]	[3]	[4]	[5]	[6]	[7]
Acct	**Description**	**I&M**	**SWEPCO**	**OG&E**	**PSO**	**Peer Avg**	**Peer Avg Less I&M**	**OUCC**
	TRANSMISSION PLANT							
354	Towers & Fixtures	66	60	75	75	70	4	75
355	Poles & Fixtures	50	50	65	46	54	4	54
	DISTRIBUTION PLANT							
364	Poles, Towers, & Fixtures	41	55	55	53	54	13	54
365	OH Conductor & Devices	39	44	54	46	48	9	48
366	UG Conduit	60	70	65	78	71	11	71
368	Line Transformers	27	50	44	36	43	16	43
369	Services	44	55	53	60	56	12	56
	Average	**47**	**55**	**59**	**56**	**57**	**10**	**57**

This figure compares I&M's proposed service life for each account, the approved service lives for the three peer companies, and my service life recommendations on behalf of OUCC. This figure also shows the average approved service lives of the peer group as well as the difference between those averages and I&M's proposed service lives. It is pertinent to note that each one of the Company's proposed service lives for these accounts is notably shorter than the average service lives of the peer group (in the third column from the right). For example, in Account 368, I&M's proposed service life is 16 years shorter than the average approved service life of the peer group (27 years vs. 43 years). This is a significant discrepancy. Colum [6] in the figure above shows the relatively shorter lives proposed by I&M for each of the accounts at issue. My recommended service lives are shown in the far-right column. I think it is also worth noting that while all of my proposed lives are longer than the Company's proposed lives for these accounts, none of my proposals exceed the average approved life of the peer group (except for Account 354, which is further discussed below). This fact further highlights the overall reasonableness of my recommended service lives in this case.

1. <u>Account 354 – Transmission Towers and Fixtures</u>

Q. Describe Mr. Cash's service life estimate for Account 354.

A. Mr. Cash selected the R5-66 curve for this account. According to the SPR analysis, this curve results in a CI score of 64 and an REI score of 100.[38] Unlike several of the accounts discussed below, several of the potential SPR results for this account, as indicated by the CI and REI scores, are both acceptable.[39]

Q. Do you agree with Mr. Cash's estimate?

A. No. The SPR results for this account show several Iowa curves for this account that could be acceptable. However, because SPR analysis is relatively less reliable than actuarial analysis, it is instructive to consider the approved service lives of the peer group that were based on actuarial analysis. Furthermore, there are Iowa curves with higher ranking CI scores on the SPR list for this account, such as the Iowa R4-75 curve. The R4-75 curve has a CI score of 70 and an REI score of 100. Furthermore a 75-year service life is closer to the average approved service life of the peer group.

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[38] Attachment DJG-2-10.

[39] *Id.*

Q. Are you aware of an approved service life for account 354 in excess of 70 years?

A. Yes. The currently approved service life for PSO's Account 354 is 75 years. This service life was recommended by PSO's witness based on the company's actuarial data.[40] No party opposed the PSO's recommendation for this account and it was adopted by the Oklahoma commission.[41]

Q. What is your recommendation for this account?

A. I recommend the Iowa R4-75 curve be applied to this account. The R4-75 curve has a higher CI score than the Iowa curve proposed by Mr. Cash, and it has a higher "excellent" REI score than the Company's curve, as measured by the scales discussed above. Furthermore, two utilities in the peer group, including PSO, I&M's sister company, have approved service lives of 75 years for Account 354.

2. <u>Account 355 – Transmission Poles and Fixtures</u>

Q. Describe Mr. Cash's service life estimate for Account 355.

A. Mr. Cash selected the L0.5-50 curve for this account. According to the SPR analysis, this curve results in a CI score of only 15, which is considered "Poor" on the CI Scale.[42]

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[40] *See*, *Application of Pub. Serv. Co. of Okla*., Docket No. PUD 201700151, Final Order No. 672864, pp. 5-6 (Corp. Comm'n of Okla. Jan. 31, 2018); *see also Application of Pub. Serv. Co. of Okla.*, Docket No. PUD 201700151, Direct Testimony of John J. Cash, Exhibit JSS-2, p. VII-71 (Corp. Comm'n of Okla. Jun. 2017).

[41] *See Application of Pub. Serv. Co. of Okla.,* Docket No. PUD 201700151, Final Order No. 672864, pp. 5-6, Application of Public Service Company of Oklahoma, Docket No. PUD 201700151 (Corp. Comm'n of Okla. Jan. 31, 2018).

[42] *See* Attachment DJG-2-8.

Q. Do you agree with Mr. Cash's estimate?

A. No. The SPR results for this account show that very few Iowa curves are acceptable based on the SPR analysis alone. In fact, one of the curves that have an acceptable CI / REI combination score is the Iowa R2.5-87 curve.[43] However, an average life of 87 years is notably longer than the observed and approved lives seen among comparable utilities. Thus, it is necessary to consider other objective information upon which to base a reasonable service life estimate, such as the approved service lives of the peer group that were based on actuarial analysis.

Q. Are you aware of an approved service life for account 355 up to 65 years?

A. Yes. The currently approved service life for OG&E's Account 355 is 65 years.[44] The average approved service life of the peer group is 54 years.[45]

Q. What is your recommendation for this account?

A. I recommend the L0.5-54 curve be applied to this account. A 54-year average life equals the average life of the peer group which is an objective measure given the poor quality of the SPR analysis presented by the Company. The curve shape of L0.5 is the same curve shape proposed by Mr. Cash.

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[43] Attachment DJG-2-10.

[44] Attachment DJG-2-7.

[45] Attachment DJG-2-9.

3. Account 364 – Distribution Poles, Towers and Fixtures

Q. Describe Mr. Cash's service life estimate for Account 364.

A. Mr. Cash selected the L0-41 curve for this account. According to the SPR analysis, this curve has a CI score of only 10, which has no analytical value.

Q. Do you agree with Mr. Cash's position?

A. No. Basing an approved service life on an Iowa curve with a CI score as low as 10 is not reasonable. A poor CI score renders the entire SPR analysis as unsatisfactory according to Bauhan. [46] When the SPR analysis is unreliable as it is here, it is necessary to consider the approved service lives for other utilities that were based on more reliable actuarial analysis.

Q. Do the approved service lives for the peer group show a significantly higher average life than that proposed by Mr. Cash?

A. Yes. The average approved service life for the peer group is 54 years, which is 13 years longer than the 41-year service life proposed by Mr. Cash. This is a significant discrepancy, especially considering that two of the peer companies I selected are sister companies to I&M. In SWEPCO's 2017 rate case in Texas, the Commission found that "[i]t is reasonable to apply an R0.5-55 Iowa-curve-life combination for FERC Account 364-*Distribution Poles*."[47] The mathematical Iowa curve analysis of SWEPCO's actuarial data for Account 364 indicated that the average service life could have been even higher –

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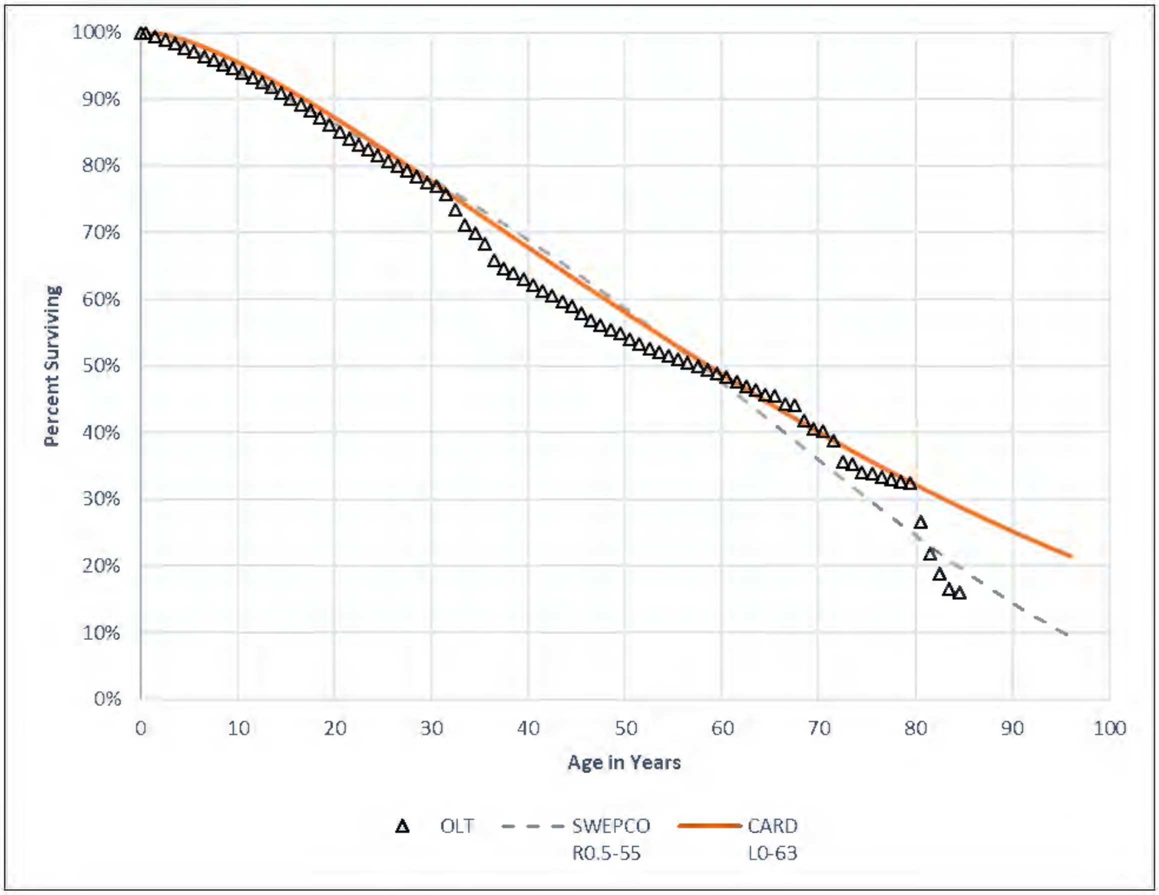
[46] Bauhan, A. E., "Life Analysis of Utility Plant for Depreciation Accounting Purposes by the Simulated Plant Record Method," 1947, Appendix of the EEl, 1952; *see also* Exhibit DJG-10.

[47] *See Application of Sw. Elec. Power Co. for Authority to Change Rates*, Docket No. 46449, Order on Rehearing, Finding of Fact 187 (Pub. Util. Comm'n of Tex. Mar. 19, 2018).

at 63 years. It is also worth noting that the analysis in the SWEPCO case was conducted on an observed survivor curve that was relatively smooth and had very sufficient retirement history. This analysis is illustrated in the graph below.

Figure 9:
SWEPCO Account 364 Service Life Estimates Based on Aged Data



Although the Commission did not accept my recommended service life for this account made on behalf of CARD in the SWEPCO case, I acknowledged that SWEPCO's proposal of a 55-year service life was "within the range of reasonableness."[48] In contrast, I do not

[48] *See Application of Sw. Elec. Power Co. for Authority to Change Rates*, Docket No. 46449, Direct Testimony and Exhibits of David J. Garrett, p. 23, Fig 6 (Pub. Util. Comm'n of Tex. Apr. 25, 2017).

believe that Mr. Cash's 35-year estimate in this case, which is based on a "Poor" SPR analysis, is within the range of reasonableness for this account.

Q. What is your service life recommendation for account 364?

A. The 35-year service life recommend by Mr. Cash for this account is remarkably short. Not only was it based on a poor and unsatisfactory SPR analysis, but it is also nearly 20 years shorter than the approved service lives of the utilities discussed above, including SWEPCO. The two other peer companies, OG&E and PSO, have approved service lives of 55 years and 53 years respectively.[49] Thus, out of the three peer companies, there is only a two-year variance in the approved service lives, further indicating that the average approved life of 54 years among the three companies is reasonable. I recommend applying the L0-54 curve for this account. An average life of 54 years equals the average of the comparable group, and the curve shape is the same as the one selected by Mr. Cash.

4. <u>Account 365 – Distribution Overhead Conductors and Devices</u>

Q. Describe Mr. Cash's service life estimate for Account 365.

A. Mr. Cash selected the L0-39 curve for this account. According to the SPR analysis, this curve results in a CI score of only 16, which is considered "Poor" on the CI Scale.[50]

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[49] Attachment DJG-2-9.

[50] *See* Attachment DJG-2-10.

Q. Do you agree with Mr. Cash's estimate?

A. No. A poor CI score renders the entire SPR analysis as unsatisfactory according to Bauhan.[51] When the SPR analysis is completely unreliable as it is here, it is necessary to consider the approved service lives for other utilities which were based on more reliable actuarial analysis.

Q. Describe the approved service lives of the peer group.

A. The approved service lives for the peer group range from 44 – 54 years, with an average approved life of 48 years.

Q. What is your recommendation for this account?

A. I recommend the L0-48 curve be applied to this account. My recommendation is based on the approved service lives of the peer group, which were based on actuarial analysis of reliable, aged data.

5. <u>Account 366 – Distribution Underground Conduit</u>

Q. Describe Mr. Cash's service life estimate for Account 366.

A. Mr. Cash selected the R2-60 curve for this account. According to the SPR analysis, this curve results in a CI score of only 47 under the longest observation band.

[51] Bauhan, A. E., "Life Analysis of Utility Plant for Depreciation Accounting Purposes by the Simulated Plant Record Method," 1947, Appendix of the EEl, 1952; *see also* Exhibit DJG-10.

Q. Do you agree with Mr. Cash's position?

A. No. Although this CI score is better than the CI scores for several accounts discussed above, it nonetheless results in an overall SPR result that is not "satisfactory" according to the creator of the SPR method. According to Bauhan, "[i]n order for a life determination to be considered entirely satisfactory, it should be required that <u>both</u> the retirements experience index and the conformance index be 'Good' or better."[52] A CI score of only 47 is not considered "Good." When the SPR analysis is not satisfactory, it is instructive to consider other objective measures upon which to assess a reasonable service life estimate, such as the approved service lives for other utilities that were based on more reliable actuarial analysis.

Q. Describe the approved service lives of the peer group.

A. The peer group analysis shows that the approved service lives for I&M's sister companies, SWEPCO and PSO, are significantly longer at 70 and 78 years respectively.[53]

Q. Please illustrate the retirement rate you have observed in this account when such rate was derived from more reliable aged data through actuarial analysis.

A. In PSO's rate case, the company's witness recommended a 65-year average life for Account 366, and I recommended a 78-year average life as estimated through visual and mathematical Iowa curve-fitting techniques. The graph below shows the OLT curve (i.e., the curve derived from the utility's historical data in black triangles), along with the two

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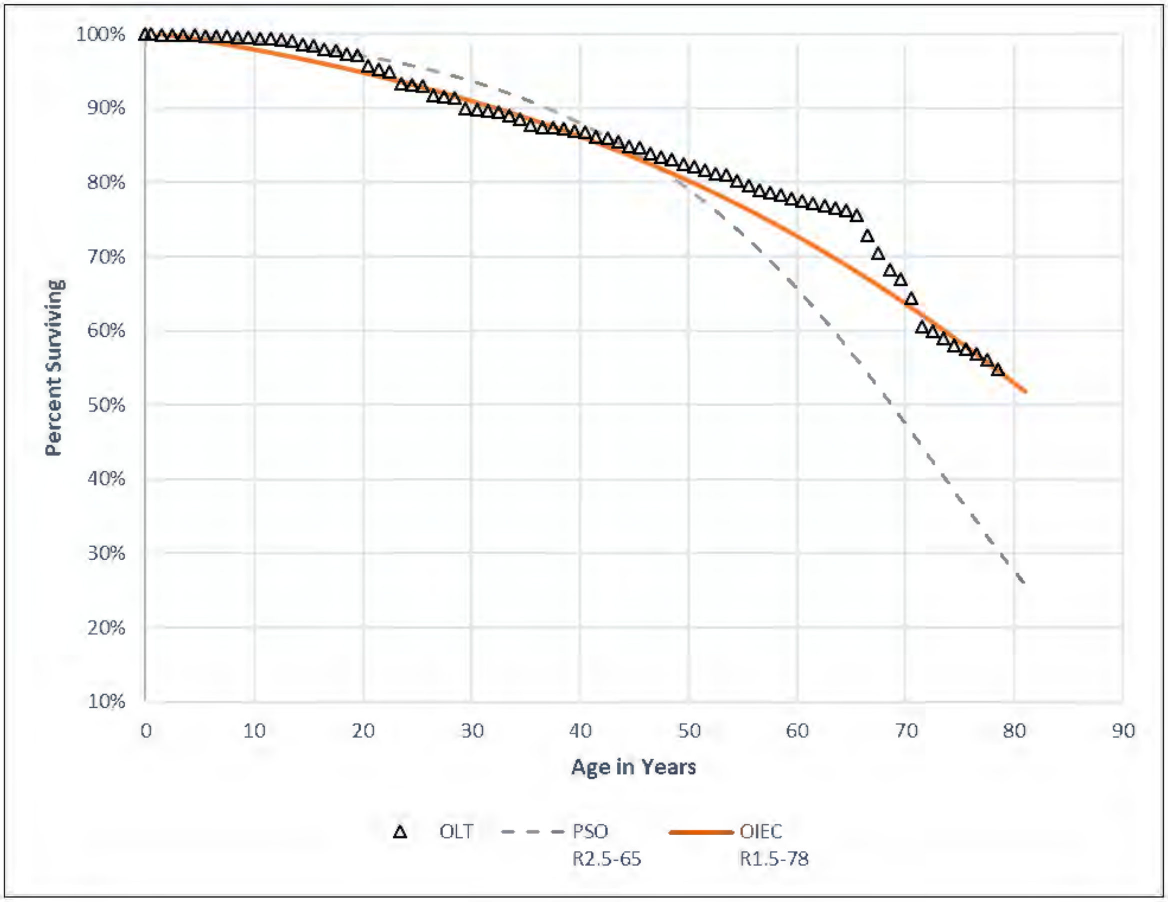
[52] *Id*. (emphasis added).

[53] Attachment DJG-2-9.

Iowa curves proposed in the PSO case. As shown in the graph, the R1.5-78 curve tracks very well with the historical retirement pattern in this account (the curve labeled "OIEC" is the curve I recommended).

Figure 10:
PSO Account 366 Service Life Estimates Based on Aged Data



When a utility keeps adequate aged data, depreciation analysts can use the actuarial retirement rate method to develop observed survivor curves like the OLT curve shown above. These curves make average life estimates more accurate and reliable. The Oklahoma commission ultimately ordered a 78-year average service life for Account 366.

Q. What is your recommendation for this account?

A. I recommend the R2-71 Iowa curve be applied to this account. An average life of 71 years is equal to the average approved life of the peer group.

6. <u>Account 368 – Distribution Line Transformers</u>

Q. Describe Mr. Cash's service life estimate for Account 368.

A. Mr. Cash selected the R0.5-27 curve for this account. According to the SPR analysis, this curve results in a CI score of only 12 under the longest observation band, which is considered "Poor" on the CI Scale.[54]

Q. Do you agree with Mr. Cash's estimate?

A. No. A CI score as low as 12 renders the SPR analysis for this account meaningless. When the SPR analysis is completely unreliable as it is here, it is necessary to consider the approved service lives for other utilities which were based on more reliable actuarial analysis.

Q. Describe the approved service lives of the peer group for Account 368.

A. The approved service life for I&M's sister company, SWEPCO, is 50 years, which is nearly twice as long as the service life proposed by Mr. Cash in this case. The average approved service life for the peer group is 43 years, which is still significantly longer than the service life proposed by Mr. Cash in this case.

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[54] *See* Attachment DJG-2-10.

Q. What is your recommendation for this account?

A. I recommend the R0.5-56 curve for this account. An average life of 56 years is equal to the average approved life for the peer group, and the curve shape is the same as the one proposed by Mr. Cash.

7. <u>Account 369 – Distribution Services</u>

Q. Describe Mr. Cash's service life estimate for Account 369.

A. Mr. Cash selected the R0.5-44 curve for this account. According to the SPR analysis, this curve results in a CI score of only 16 under the longest observation band, which is considered "Poor" on the CI Scale.[55]

Q. Do you agree with Mr. Cash's estimate?

A. No. A CI score as low as 16 renders the SPR analysis for this account meaningless. When the SPR analysis is completely unreliable as it is here, it is necessary to consider other objective factors upon which to base the service life estimate for this account, such as the approved service lives for other utilities which were based on more reliable actuarial data.

Q. Describe the approved service lives of the peer group for Account 369.

A. The approved service life for the peer group for this account range from 53 – 60 years, all of which are notably higher than Mr. Cash's proposed service life of only 40 years. I&M's sister company, PSO, has an approved service life of 60 years for this account, which is remarkably higher than Mr. Cash's recommendation.

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[55] *See* Attachment DJG-2-10.

Q. What is your recommendation for this account?

A. I recommend the R0.5-56 curve for this account. An average life of 56 years is equal to the average approved life for the peer group, and the curve shape is the same one selected by Mr. Cash.

Q. Does this conclude your testimony?

A. Yes.

APPENDIX A:

THE DEPRECIATION SYSTEM

A depreciation accounting system may be thought of as a dynamic system in which estimates of life and salvage are inputs to the system, and the accumulated depreciation account is a measure of the state of the system at any given time.[56] The primary objective of the depreciation system is the timely recovery of capital. The process for calculating the annual accruals is determined by the factors required to define the system. A depreciation system should be defined by four primary factors: 1) a method of allocation; 2) a procedure for applying the method of allocation to a group of property; 3) a technique for applying the depreciation rate; and 4) a model for analyzing the characteristics of vintage groups comprising a continuous property group.[57] The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.[58]

There are hundreds of potential combinations of methods, procedures, techniques, and models, but in practice, analysts use only a few combinations. Ultimately, the system selected must result in the systematic and rational allocation of capital recovery for the utility. Each of the four primary factors defining the parameters of a depreciation system is discussed further below.

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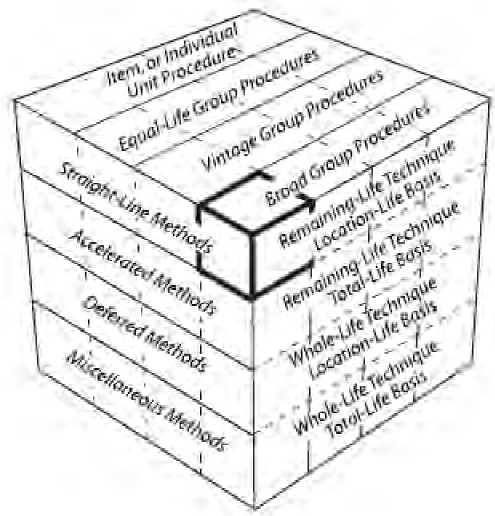
[56] Wolf *supra* n. 9, at 69-70.

[57] *Id.* at 70, 139-40.

[58] Edison Electric Institute, *Introduction to Depreciation* (inside cover) (EEI April 2013). Some definitions of the terms shown in this diagram are not consistent among depreciation practitioners and literature due to the fact that depreciation analysis is a relatively small and fragmented field. This diagram simply illustrates some of the available parameters of a depreciation system.

Figure 11:
The Depreciation System Cube



The "method" refers to the pattern of depreciation in relation to the accounting periods. The method most commonly used in the regulatory context is the "straight-line method" – a type of age-life method in which the depreciable cost of plant is charged in equal amounts to each accounting period over the service life of plant.[59] Because group depreciation rates and plant balances often change, the amount of the annual accrual rarely remains the same, even when the straight-line method is employed.[60] The basic formula for the straight-line method is as follows:[61]

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[59] NARUC *supra* n. 10, at 56.

[60] *Id*.

[61] *Id*.

Equation 1:
Straight-Line Accrual

$$Annual\ Accrual = \frac{Gross\ Plant - Net\ Salvage}{Service\ Life}$$

Gross plant is a known amount from the utility's records, while both net salvage and service life must be estimated to calculate the annual accrual. The straight-line method differs from accelerated methods of recovery, such as the "sum-of-the-years-digits" method and the "declining balance" method. Accelerated methods are primarily used for tax purposes and are rarely used in the regulatory context for determining annual accruals.[62] In practice, the annual accrual is expressed as a rate which is applied to the original cost of plant to determine the annual accrual in dollars. The formula for determining the straight-line rate is as follows:[63]

Equation 2:
Straight-Line Rate

$$Depreciation\ Rate\ \% = \frac{100 - Net\ Salvage\ \%}{Service\ Life}$$

2. Grouping Procedures

The "procedure" refers to the way the allocation method is applied through subdividing the total property into groups.[64] While single units may be analyzed for depreciation, a group plan of depreciation is particularly adaptable to utility property. Employing a grouping procedure allows for a composite application of depreciation rates to groups of similar property, rather than

[62] *Id*. at 57.
[63] *Id*. at 56.
[64] Wolf *supra* n. 9, at 74-75.

conducting calculations for each unit. Whereas an individual unit of property has a single life, a group of property displays a dispersion of lives, and the life characteristics of the group must be described statistically.[65] When analyzing mass property categories, it is important that each group contains homogenous units of plant that are used in the same general manner throughout the plant and operated under the same general conditions.[66]

The "average life" and "equal life" grouping procedures are the two most common. In the average life procedure, a constant annual accrual rate based on the average life of all property in the group is applied to the surviving property. While property having shorter lives than the group average will not be fully depreciated, and likewise, property having longer lives than the group average will be over-depreciated, the ultimate result is that the group will be fully depreciated by the time of the final retirement.[67] Thus, the average life procedure treats each unit as though its life is equal to the average life of the group. In contrast, the equal life procedure treats each unit in the group as though its life was known.[68] Under the equal life procedure the property is divided into subgroups that each has a common life.[69]

3. Application Techniques

The third factor of a depreciation system is the "technique" for applying the depreciation rate. There are two commonly used techniques: "whole life" and "remaining life." The whole life

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[65] *Id*. at 74.

[66] NARUC *supra* n. 10, at 61-62.

[67] *See* Wolf *supr*a n. 9, at 74-75.

[68] *Id*. at 75.

[69] *Id*.

technique applies the depreciation rate on the estimated average service life of a group, while the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[70]

In choosing the application technique, consideration should be given to the proper level of the accumulated depreciation account. Depreciation accrual rates are calculated using estimates of service life and salvage. Periodically these estimates must be revised due to changing conditions, which cause the accumulated depreciation account to be higher or lower than necessary. Unless some corrective action is taken, the annual accruals will not equal the original cost of the plant at the time of final retirement.[71] Analysts can calculate the level of imbalance in the accumulated depreciation account by determining the "calculated accumulated depreciation," (a.k.a. "theoretical reserve" and referred to in these appendices as "CAD"). The CAD is the calculated balance that would be in the accumulated depreciation account at a point in time using current depreciation parameters.[72] An imbalance exists when the actual accumulated depreciation account does not equal the CAD. The choice of application technique will affect how the imbalance is dealt with.

Use of the whole life technique requires that an adjustment be made to accumulated depreciation after calculation of the CAD. The adjustment can be made in a lump sum or over a period of time. With use of the remaining life technique, however, adjustments to accumulated depreciation are amortized over the remaining life of the property and are automatically included

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[70] NARUC *supra* n. 10, at 63-64.

[71] Wolf *supra* n. 9, at 83.

[72] NARUC *supra* n. 10, at 325.

in the annual accrual.[73] This is one reason that the remaining life technique is popular among practitioners and regulators. The basic formula for the remaining life technique is as follows:[74]

Equation 3:
Remaining Life Accrual

$$Annual\ Accrual = \frac{Gross\ Plant - Accumulated\ Depreciation - Net\ Salvage}{Average\ Remaining\ Life}$$

The remaining life accrual formula is similar to the basic straight-line accrual formula above with two notable exceptions. First, the numerator has an additional factor in the remaining life formula: the accumulated depreciation. Second, the denominator is "average remaining life" instead of "average life." Essentially, the future accrual of plant (gross plant less accumulated depreciation) is allocated over the remaining life of plant. Thus, the adjustment to accumulated depreciation is "automatic" in the sense that it is built into the remaining life calculation.[75]

4. <u>Analysis Model</u>

The fourth parameter of a depreciation system, the "model," relates to the way of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group for depreciation purposes.[76] A continuous property group is created when vintage groups are combined to form a common group. Over time, the characteristics of the property may change, but the continuous property group will continue. The two analysis models

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[73] NARUC *supra* n. 10, at 65 ("The desirability of using the remaining life technique is that any necessary adjustments of [accumulated depreciation] . . . are accrued automatically over the remaining life of the property. Once commenced, adjustments to the depreciation reserve, outside of those inherent in the remaining life rate would require regulatory approval.").

[74] *Id*. at 64.

[75] Wolf *supra* n. 9, at 178.

[76] *See* Wolf *supra* n. 9, at 139 (I added the term "model" to distinguish this fourth depreciation system parameter from the other three parameters).

used among practitioners, the "broad group" and the "vintage group," are two ways of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group.

The broad group model views the continuous property group as a collection of vintage groups that each have the same life and salvage characteristics. Thus, a single survivor curve and a single salvage schedule are chosen to describe all the vintages in the continuous property group. In contrast, the vintage group model views the continuous property group as a collection of vintage groups that may have different life and salvage characteristics. Typically, there is not a significant difference between vintage group and broad group results unless vintages within the applicable property group experienced dramatically different retirement levels than anticipated in the overall estimated life for the group. For this reason, many analysts utilize the broad group procedure because it is more efficient.

APPENDIX B:

IOWA CURVES

Early work in the analysis of the service life of industrial property was based on models that described the life characteristics of human populations.[77] This explains why the word "mortality" is often used in the context of depreciation analysis. In fact, a group of property installed during the same accounting period is analogous to a group of humans born during the same calendar year. Each period the group will incur a certain fraction of deaths / retirements until there are no survivors. Describing this pattern of mortality is part of actuarial analysis and is regularly used by insurance companies to determine life insurance premiums. The pattern of mortality may be described by several mathematical functions, particularly the survivor curve and frequency curve. Each curve may be derived from the other so that if one curve is known, the other may be obtained. A survivor curve is a graph of the percent of units remaining in service expressed as a function of age.[78] A frequency curve is a graph of the frequency of retirements as a function of age. Several types of survivor and frequency curves are illustrated in the figures below.

1. Development

The survivor curves used by analysts today were developed over several decades from extensive analysis of utility and industrial property. In 1931, Edwin Kurtz and Robley Winfrey used extensive data from a range of 65 industrial property groups to create survivor curves representing the life characteristics of each group of property.[79] They generalized the 65 curves

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[77] Wolf *supra* n. 9, at 276.

[78] *Id*. at 23.

[79] *Id*. at 34.

into 13 survivor curve types and published their results in *Bulletin 103: Life Characteristics of Physical Property*. The 13 type curves were designed to be used as valuable aids in forecasting probable future service lives of industrial property. Over the next few years, Winfrey continued gathering additional data, particularly from public utility property, and expanded the examined property groups from 65 to 176.[80] This resulted in 5 additional survivor curve types for a total of 18 curves. In 1935, Winfrey published *Bulletin 125: Statistical Analysis of Industrial Property Retirements*. According to Winfrey, "[t]he 18 type curves are expected to represent quite well all survivor curves commonly encountered in utility and industrial practices."[81] These curves are known as the "Iowa curves" and are used extensively in depreciation analysis in order to obtain the average service lives of property groups. (Use of Iowa curves in actuarial analysis is further discussed in Appendix C.)

In 1942, Winfrey published *Bulletin 155: Depreciation of Group Properties*. In Bulletin 155, Winfrey made some slight revisions to a few of the 18 curve types, and published the equations, tables of the percent surviving, and probable life of each curve at five-percent intervals.[82] Rather than using the original formulas, analysts typically rely on the published tables containing the percentages surviving. This is because absent knowledge of the integration technique applied to each age interval, it is not possible to recreate the exact original published table values. In the 1970s, John Russo collected data from over 2,000 property accounts reflecting

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[80] *Id*.

[81] Robley Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 85, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

[82] Robley Winfrey, Bulletin 155: Depreciation of Group Properties 121-28, Vol XLI, No. 1 (The Iowa State College Bulletin 1942); see also Wolf supra n. 9, at 305-38 (publishing the percent surviving for each Iowa curve, including "O" type curve, at one percent intervals).

observations during the period 1965 – 1975 as part of his Ph.D. dissertation at Iowa State. Russo essentially repeated Winfrey's data collection, testing, and analysis methods used to develop the original Iowa curves, except that Russo studied industrial property in service several decades after Winfrey published the original Iowa curves. Russo drew three major conclusions from his research:[83]

1. No evidence was found to conclude that the Iowa curve set, as it stands, is not a valid system of standard curves;

2. No evidence was found to conclude that new curve shapes could be produced at this time that would add to the validity of the Iowa curve set; and

3. No evidence was found to suggest that the number of curves within the Iowa curve set should be reduced.

Prior to Russo's study, some had criticized the Iowa curves as being potentially obsolete because their development was rooted in the study of industrial property in existence during the early 1900s. Russo's research, however, negated this criticism by confirming that the Iowa curves represent a sufficiently wide range of life patterns, and that though technology will change over time, the underlying patterns of retirements remain constant and can be adequately described by the Iowa curves.[84]

Over the years, several more curve types have been added to Winfrey's 18 Iowa curves. In 1967, Harold Cowles added four origin-modal curves. In addition, a square curve is sometimes used to depict retirements which are all planned to occur at a given age. Finally, analysts

[83] *See* Wolf *supra* n. 9, at 37.

[84] *Id*.

commonly rely on several "half curves" derived from the original Iowa curves. Thus, the term "Iowa curves" could be said to describe up to 31 standardized survivor curves.

2. Classification

The Iowa curves are classified by three variables: modal location, average life, and variation of life. First, the mode is the percent life that results in the highest point of the frequency curve and the "inflection point" on the survivor curve. The modal age is the age at which the greatest rate of retirement occurs. As illustrated in the figure below, the modes appear at the steepest point of each survivor curve in the top graph, as well as the highest point of each corresponding frequency curve in the bottom graph.

The classification of the survivor curves was made according to whether the mode of the retirement frequency curves was to the left, to the right, or coincident with average service life. There are three modal "families" of curves: six left modal curves (L0, L1, L2, L3, L4, L5); five right modal curves (R1, R2, R3, R4, R5); and seven symmetrical curves (S0, S1, S2, S3, S4, S5, S6).[85] In the figure below, one curve from each family is shown: L0, S3 and R1, with average life at 100 on the x-axis. It is clear from the graphs that the modes for the L0 and R1 curves appear to the left and right of average life respectively, while the S3 mode is coincident with average life.

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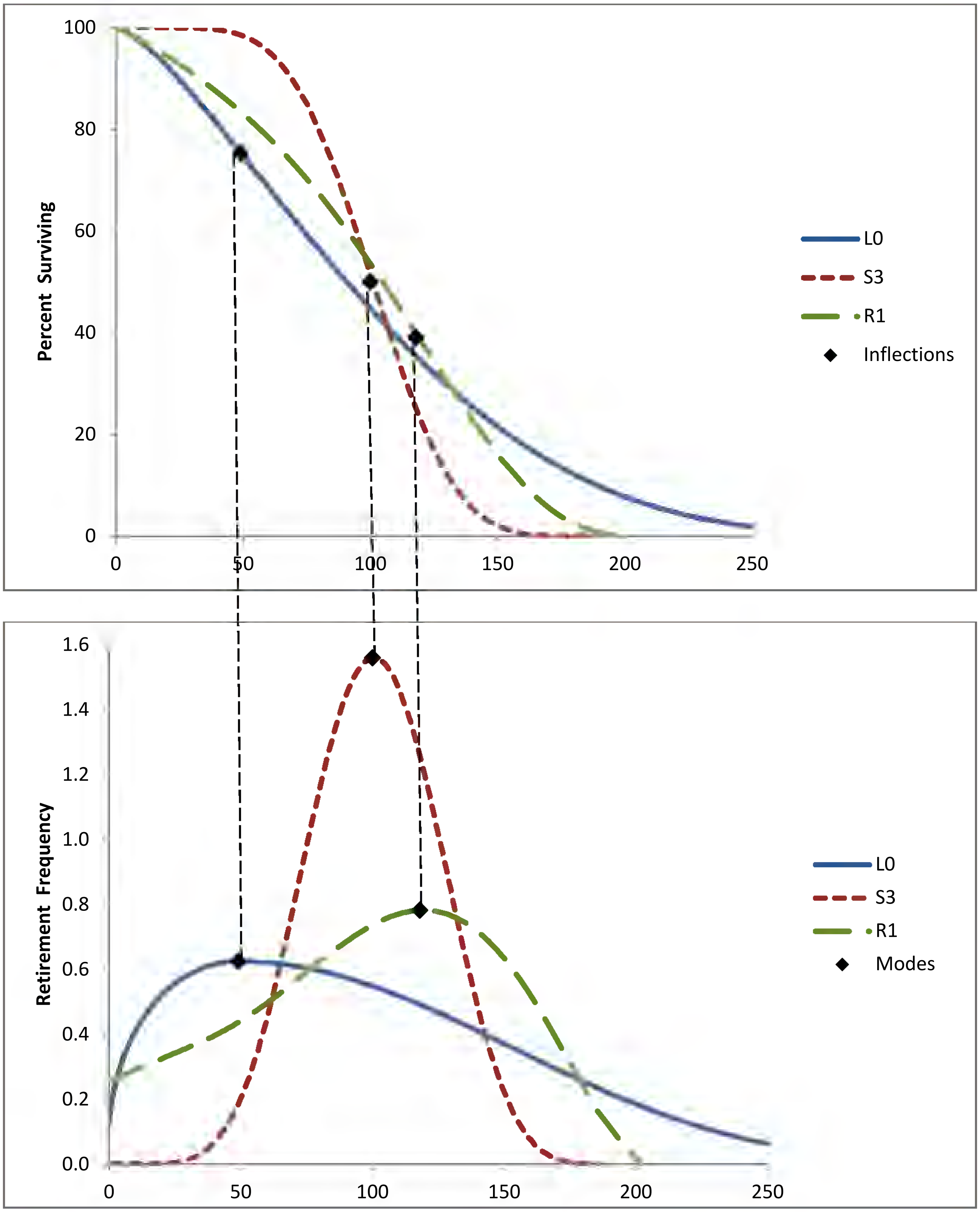
[85] In 1967, Harold A. Cowles added four origin-modal curves known as "O type" curves. There are also several "half" curves and a square curve, so the total amount of survivor curves commonly called "Iowa" curves is about 31 (see NARUC supra n. 10, at 68).

Figure 12:
Modal Age Illustration



The second Iowa curve classification variable is average life. The Iowa curves were designed using a single parameter of age expressed as a percent of average life instead of actual age. This was necessary for the curves to be of practical value. As Winfrey notes:

> Since the location of a particular survivor on a graph is affected by both its span in years and the shape of the curve, it is difficult to classify a group of curves unless one of these variables can be controlled. This is easily done by expressing the age in percent of average life."[86]

Because age is expressed in terms of percent of average life, any particular Iowa curve type can be modified to forecast property groups with various average lives.

The third variable, variation of life, is represented by the numbers next to each letter. A lower number (e.g., L1) indicates a relatively low mode, large variation, and large maximum life; a higher number (e.g., L5) indicates a relatively high mode, small variation, and small maximum life. All three classification variables – modal location, average life, and variation of life – are used to describe each Iowa curve. For example, a 13-L1 Iowa curve describes a group of property with a 13-year average life, with the greatest number of retirements occurring before (or to the left of) the average life, and a relatively low mode. The graphs below show these 18 survivor curves, organized by modal family.

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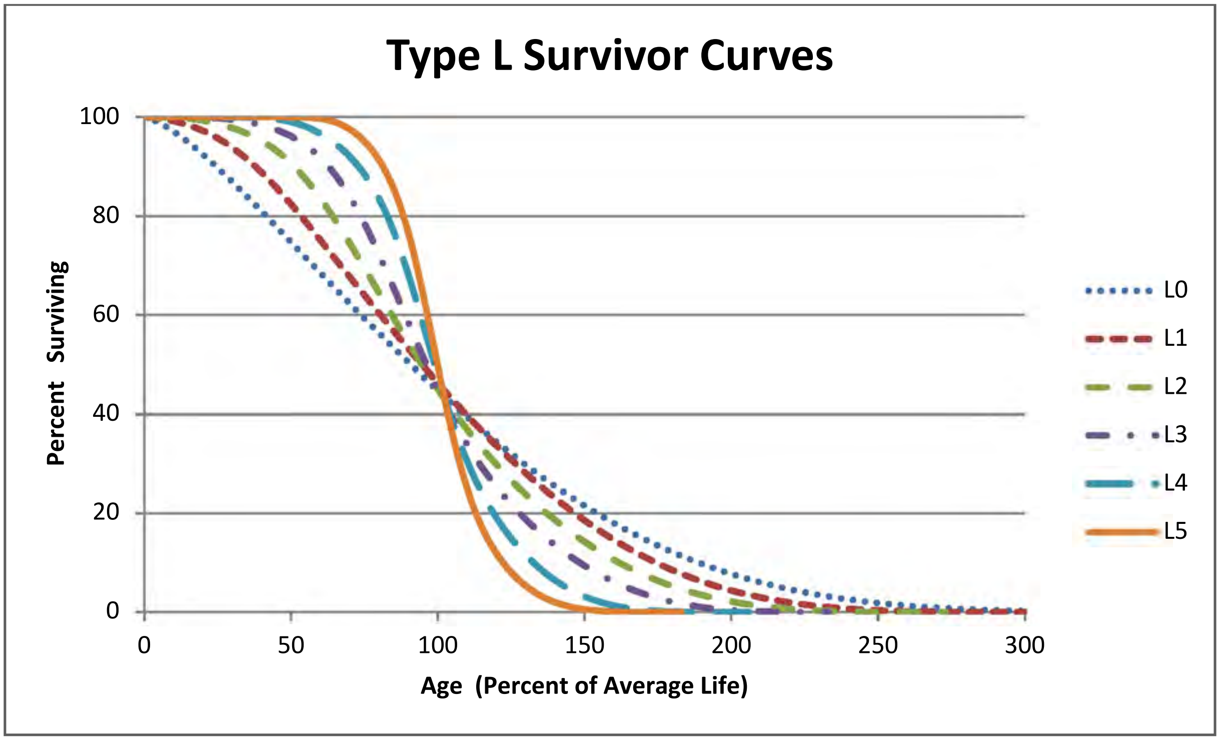
[86] Winfrey *supra* n. 75, at 60.

Figure 13:
Type L Survivor and Frequency Curves



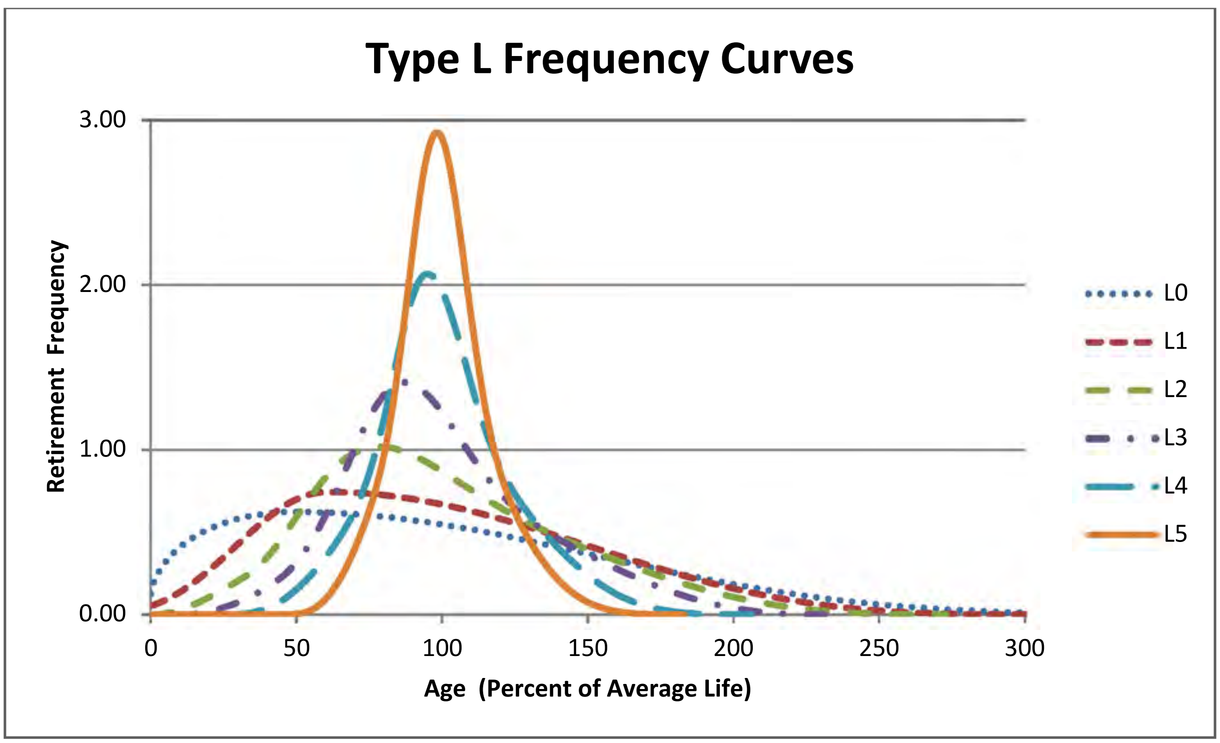
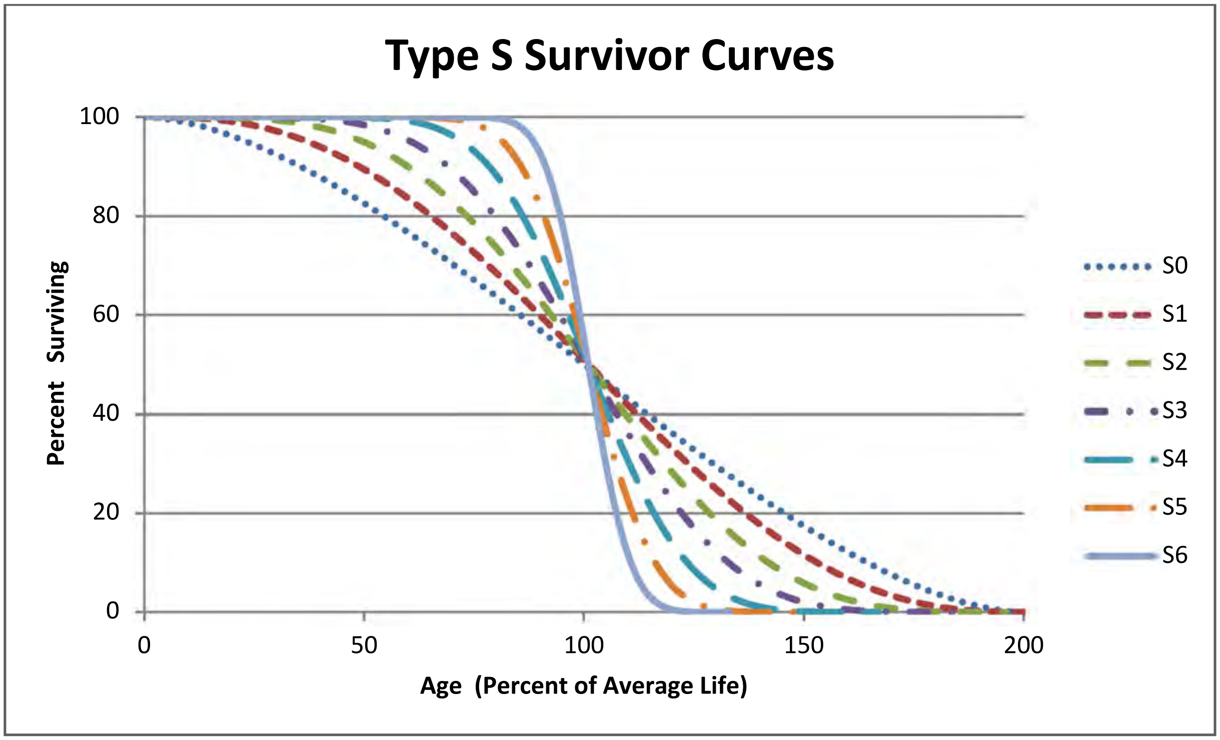


Figure 14:
Type S Survivor and Frequency Curves



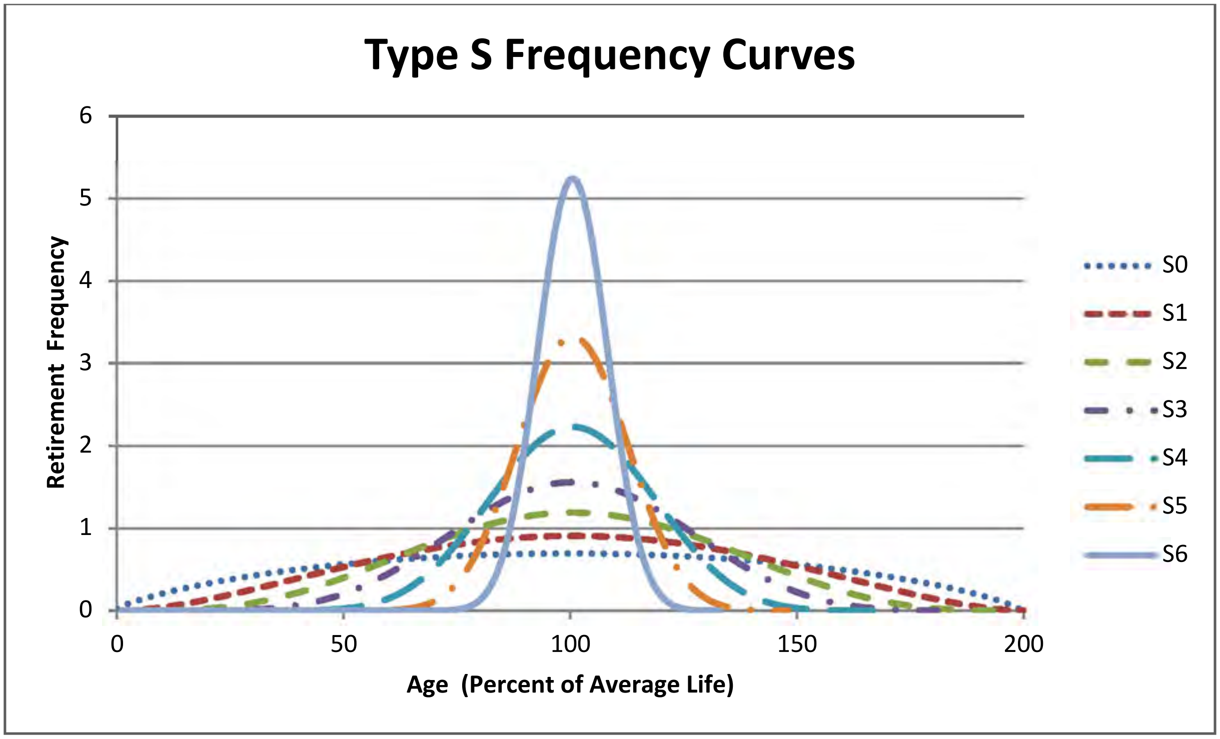
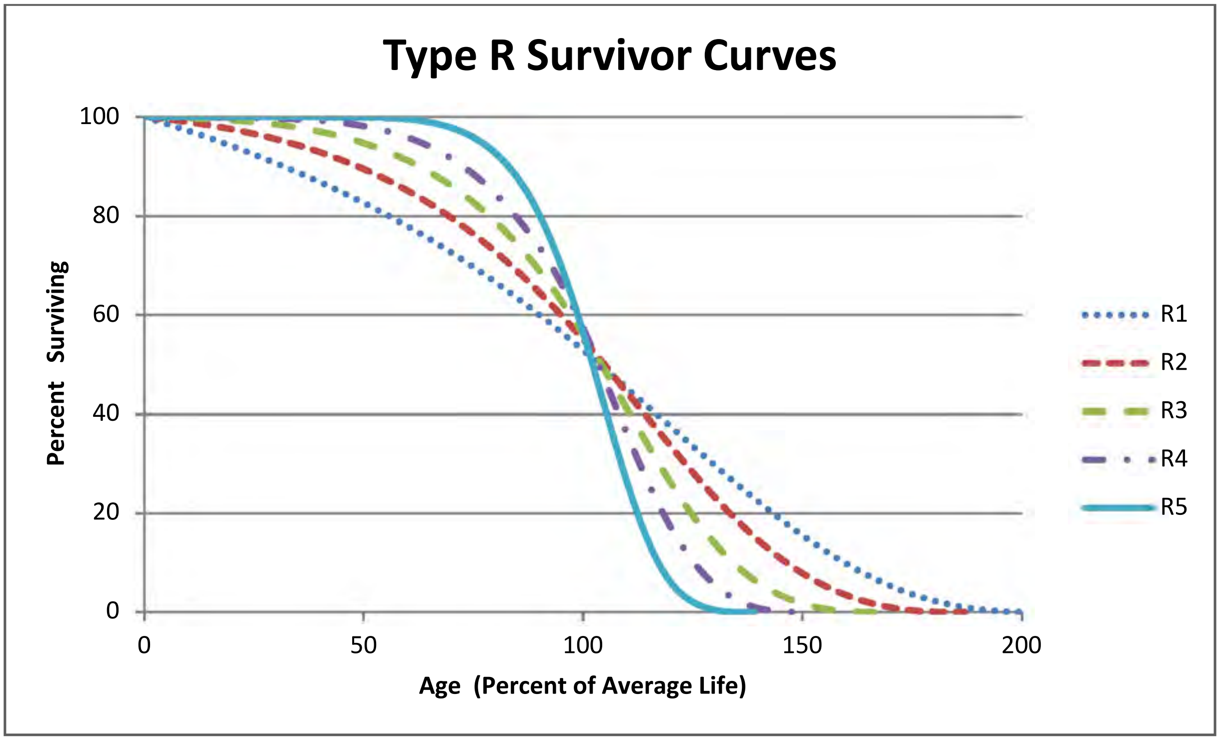
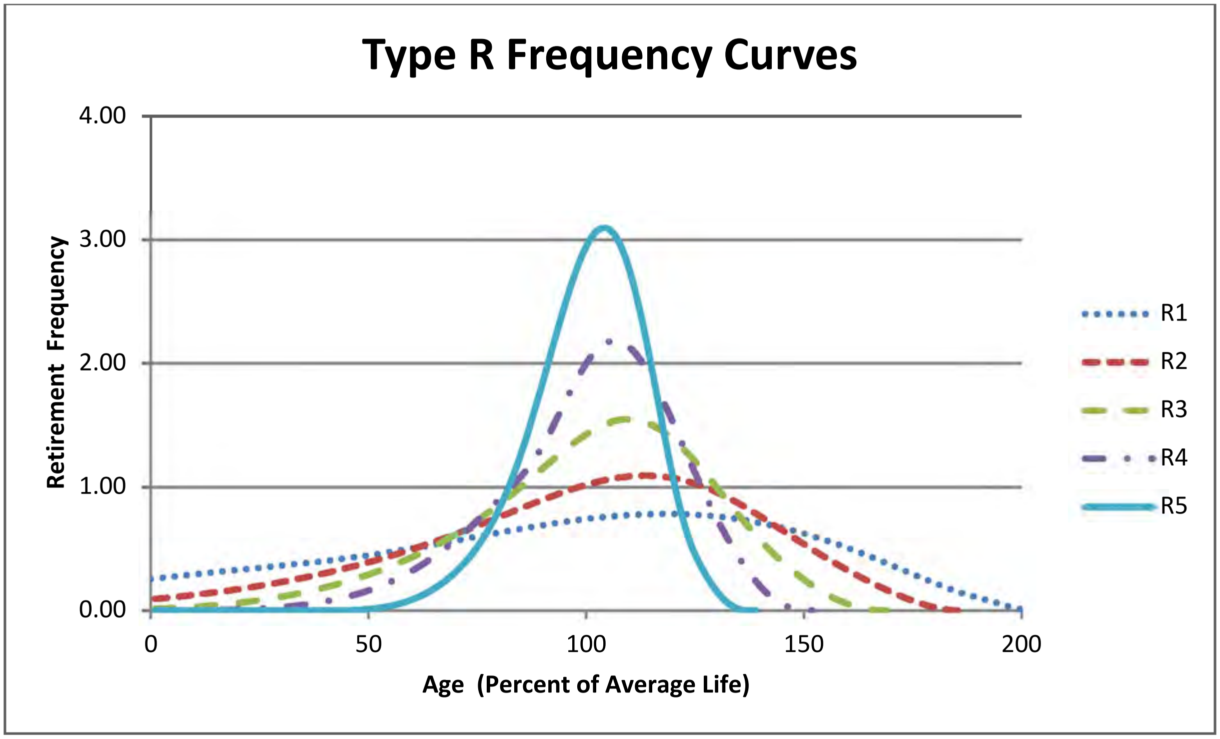


Figure 15:
Type R Survivor and Frequency Curves





As shown in the graphs above, the modes for the L family frequency curves occur to the left of average life (100% on the x-axis), while the S family modes occur at the average, and the R family modes occur after the average.

3. Types of Lives

Several other important statistical analyses and types of lives may be derived from an Iowa curve. These include: 1) average life; 2) realized life; 3) remaining life; and 4) probable life. The figure below illustrates these concepts. It shows the frequency curve, survivor curve, and probable life curve. Age M_x on the x-axis represents the modal age, while age AL_x represents the average age. Thus, this figure illustrates an "L type" Iowa curve since the mode occurs before the average.[87]

First, average life is the area under the survivor curve from age zero to maximum life. Because the survivor curve is measured in percent, the area under the curve must be divided by 100% to convert it from percent-years to years. The formula for average life is as follows:[88]

Equation 4:
Average Life

$$Average\ Life\ = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ 0\ to\ Max\ Life}{100\%}$$

Thus, average life may not be determined without a complete survivor curve. Many property groups being analyzed will not have experienced full retirement. This results in a "stub" survivor

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[87] From age zero to age M_x on the survivor curve, it could be said that the percent surviving from this property group is decreasing at an increasing rate. Conversely, from point M_x to maximum on the survivor curve, the percent surviving is decreasing at a decreasing rate.

[88] *See* NARUC *supra* n. 10, at 71.

curve. Iowa curves are used to extend stub curves to maximum life in order for the average life calculation to be made (see Appendix C).

Realized life is similar to average life, except that realized life is the average years of service experienced to date from the vintage's original installations.[89] As shown in the figure below, realized life is the area under the survivor curve from zero to age RL_X. Likewise, unrealized life is the area under the survivor curve from age RL_X to maximum life. Thus, it could be said that average life equals realized life plus unrealized life.

Average remaining life represents the future years of service expected from the surviving property.[90] Remaining life is sometimes referred to as "average remaining life" and "life expectancy." To calculate average remaining life at age x, the area under the estimated future portion of the survivor curve is divided by the percent surviving at age x (denoted S_X). Thus, the average remaining life formula is:

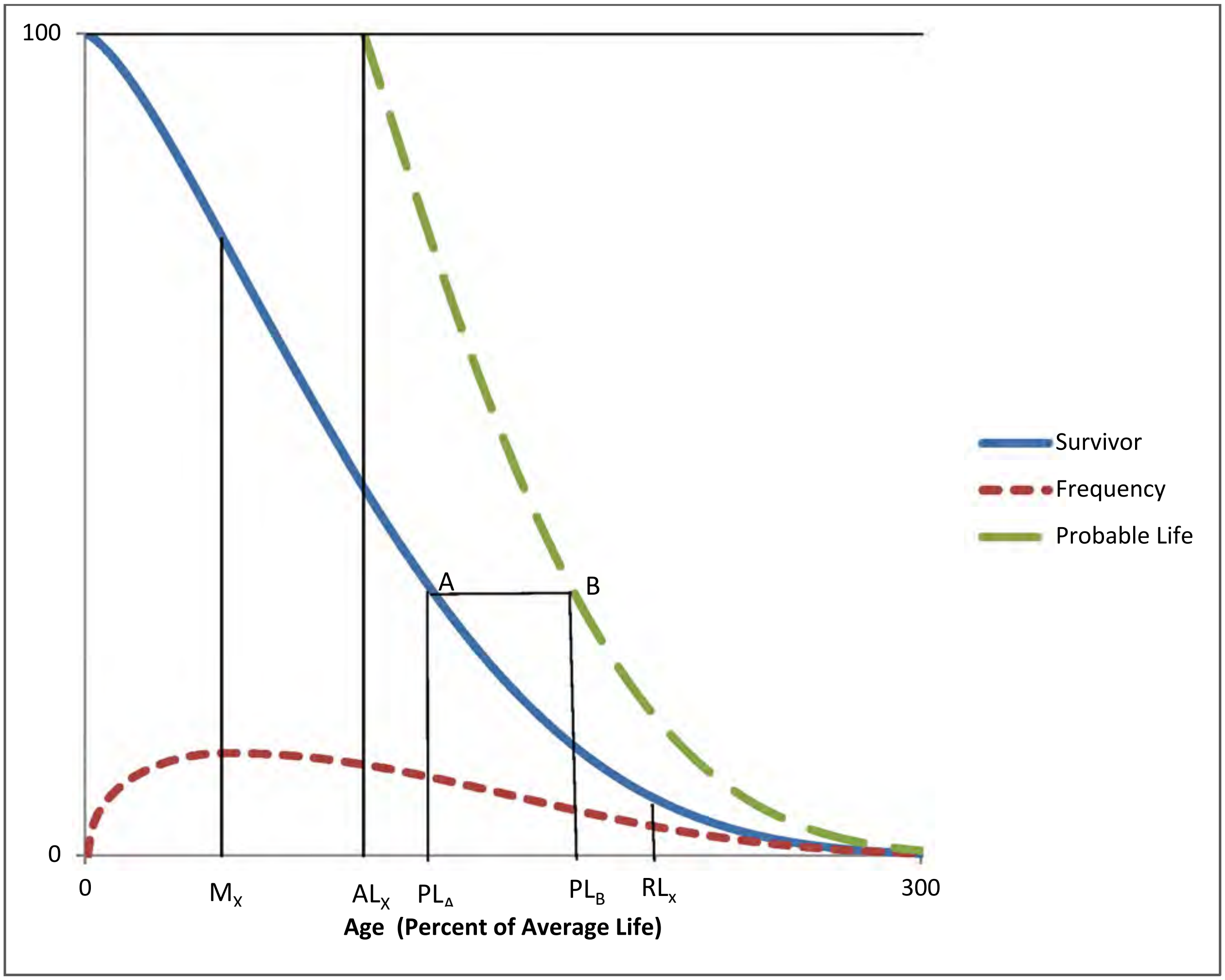
Equation 5:
Average Remaining Life

$$Average\ Remaining\ Life\ = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ x\ to\ Max\ Life}{S_X}$$

It is necessary to determine average remaining life to calculate the annual accrual under the remaining life technique.

[89] *Id*. at 73.
[90] *Id*. at 74.

Figure 16:
Iowa Curve Derivations



Finally, the probable life may also be determined from the Iowa curve. The probable life of a property group is the total life expectancy of the property surviving at any age and is equal to the remaining life plus the current age.[91] The probable life is also illustrated in this figure. The probable life at age PL_A is the age at point PL_B. Thus, to read the probable life at age PL_A, see the

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[91] Wolf *supra* n. 9, at 28.

corresponding point on the survivor curve above at point “A,” then horizontally to point “B” on the probable life curve, and back down to the age corresponding to point “B.” It is no coincidence that the vertical line from AL_X connects at the top of the probable life curve. This is because at age zero, probable life equals average life.

APPENDIX C:

ACTUARIAL ANALYSIS

Actuarial science is a discipline that applies various statistical methods to assess risk probabilities and other related functions. Actuaries often study human mortality. The results from historical mortality data are used to predict how long similar groups of people who are alive today will live. Insurance companies rely on actuarial analysis in determining premiums for life insurance policies.

The study of human mortality is analogous to estimating service lives of industrial property groups. While some humans die solely from chance, most deaths are related to age; that is, death rates generally increase as age increases. Similarly, physical plant is also subject to forces of retirement. These forces include physical, functional, and contingent factors, as shown in the table below.[92]

Figure 17:
Forces of Retirement

Physical Factors	Functional Factors	Contingent Factors
Wear and tear Decay or deterioration Action of the elements	Inadequacy Obsolescence Changes in technology Regulations Managerial discretion	Casualties or disasters Extraordinary obsolescence

While actuaries study historical mortality data in order to predict how long a group of people will live, depreciation analysts must look at a utility's historical data in order to estimate the average lives of property groups. A utility's historical data is often contained in the Continuing Property Records ("CPR"). Generally, a CPR should contain 1) an inventory of property record

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[92] NARUC *supra* n. 10, at 14-15.

units; 2) the association of costs with such units; and 3) the dates of installation and removal of plant. Since actuarial analysis includes the examination of historical data to forecast future retirements, the historical data used in the analysis should not contain events that are anomalous or unlikely to recur.[93] Historical data is used in the retirement rate actuarial method, which is discussed further below.

The Retirement Rate Method

There are several systematic actuarial methods that use historical data to calculate observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.[94] The retirement rate method is ultimately used to develop an observed survivor curve, which can be fitted with an Iowa curve discussed in Appendix B to forecast average life. The observed survivor curve is calculated by using an observed life table ("OLT"). The figures below illustrate how the OLT is developed. First, historical property data are organized in a matrix format, with placement years on the left forming rows, and experience years on the top forming columns. The placement year (a.k.a. "vintage year" or "installation year") is the year of placement into service of a group of property. The experience year (a.k.a. "activity year") refers to the accounting data for a particular calendar year. The two matrices below use aged data – that is, data for which the dates of placements, retirements, transfers, and other transactions are known. Without aged data, the retirement rate actuarial method may not be employed. The first matrix is the exposure matrix, which shows the exposures

[93] *Id*. at 112-13.

[94] Anson Marston, Robley Winfrey & Jean C. Hempstead, *Engineering Valuation and Depreciation* 154 (2nd ed., McGraw-Hill Book Company, Inc. 1953).

at the beginning of each year.[95] An exposure is simply the depreciable property subject to retirement during a period. The second matrix is the retirement matrix, which shows the annual retirements during each year. Each matrix covers placement years 2003–2015, and experience years 2008-2015. In the exposure matrix, the number in the 2012 experience column and the 2003 placement row is $192,000. This means at the beginning of 2012, there was $192,000 still exposed to retirement from the vintage group placed in 2003. Likewise, in the retirement matrix, $19,000 of the dollars invested in 2003 were retired during 2012.

Figure 18:
Exposure Matrix

Placement Years	Experience Years Exposures at January 1 of Each Year (Dollars in 000's) 2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
2003	261	245	228	211	**192**	173	152	131	131	11.5 - 12.5
2004	267	252	236	220	202	**184**	165	145	297	10.5 - 11.5
2005	304	291	277	263	248	232	**216**	198	536	9.5 - 10.5
2006	345	334	322	310	298	284	270	**255**	**847**	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	1,201	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,581	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,986	5.5 - 6.5
2010			381	369	358	347	336	327	2,404	4.5 - 5.5
2011				386	372	359	346	334	2,559	3.5 - 4.5
2012					395	380	366	352	2,722	2.5 - 3.5
2013						401	385	370	2,866	1.5 - 2.5
2014							410	393	2,998	0.5 - 1.5
2015								416	3,141	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	23,268	

[95] Technically, the last numbers in each column are "gross additions" rather than exposures. Gross additions do not include adjustments and transfers applicable to plant placed in a previous year. Once retirements, adjustments, and transfers are factored in, the balance at the beginning of the next accounting period is called an "exposure" rather than an addition.

Figure 19:
Retirement Matrix

Placement Years	Experience Years Retirments During the Year (Dollars in 000's) 2008	2009	2010	2011	2012	2013	2014	2015	Total During Age Interval	Age Interval
2003	16	17	18	19	**19**	20	21	23	23	11.5 - 12.5
2004	15	16	17	17	18	**19**	20	21	43	10.5 - 11.5
2005	13	14	14	15	16	17	**17**	18	59	9.5 - 10.5
2006	11	12	12	13	13	14	15	**15**	**71**	8.5 - 9.5
2007	10	11	11	12	12	13	13	14	82	7.5 - 8.5
2008	9	9	10	10	11	11	12	13	91	6.5 - 7.5
2009		11	10	10	9	9	9	8	95	5.5 - 6.5
2010			12	11	11	10	10	9	100	4.5 - 5.5
2011				14	13	13	12	11	93	3.5 - 4.5
2012					15	14	14	13	91	2.5 - 3.5
2013						16	15	14	93	1.5 - 2.5
2014							17	16	100	0.5 - 1.5
2015								18	112	0.0 - 0.5
Total	74	89	104	121	139	157	175	194	1,052	

These matrices help visualize how exposure and retirement data are calculated for each age interval. An age interval is typically one year. A common convention is to assume that any unit installed during the year is installed in the middle of the calendar year (i.e., July 1st). This convention is called the "half-year convention" and effectively assumes that all units are installed uniformly during the year.[96] Adoption of the half-year convention leads to age intervals of 0-0.5 years, 0.5-1.5 years, etc., as shown in the matrices.

The purpose of the matrices is to calculate the totals for each age interval, which are shown in the second column from the right in each matrix. This column is calculated by adding each number from the corresponding age interval in the matrix. For example, in the exposure matrix, the total amount of exposures at the beginning of the 8.5-9.5 age interval is $847,000. This number was calculated by adding the numbers shown on the "stairs" to the left (192+184+216+255=847).

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[96] Wolf *supra* n. 9, at 22.

The same calculation is applied to each number in the column. The amounts retired during the year in the retirements matrix affect the exposures at the beginning of each year in the exposures matrix. For example, the amount exposed to retirement in 2008 from the 2003 vintage is $261,000. The amount retired during 2008 from the 2003 vintage is $16,000. Thus, the amount exposed to retirement at the beginning of 2009 from the 2003 vintage is $245,000 ($261,000 - $16,000). The company's property records may contain other transactions which affect the property, including sales, transfers, and adjusting entries. Although these transactions are not shown in the matrices above, they would nonetheless affect the amount exposed to retirement at the beginning of each year.

The totaled amounts for each age interval in both matrices are used to form the exposure and retirement columns in the OLT, as shown in the chart below. This chart also shows the retirement ratio and the survivor ratio for each age interval. The retirement ratio for an age interval is the ratio of retirements during the interval to the property exposed to retirement at the beginning of the interval. The retirement ratio represents the probability that the property surviving at the beginning of an age interval will be retired during the interval. The survivor ratio is simply the complement to the retirement ratio (1 – retirement ratio). The survivor ratio represents the probability that the property surviving at the beginning of an age interval will survive to the next age interval.

Figure 20:
Observed Life Table

Age at Start of Interval	Exposures at Start of Age Interval	Retirements During Age Interval	Retirement Ratio	Survivor Ratio	Percent Surviving at Start of Age Interval
A	B	C	D = C / B	E = 1 - D	F
0.0	3,141	112	0.036	0.964	**100.00**
0.5	2,998	100	0.033	0.967	**96.43**
1.5	2,866	93	0.032	0.968	**93.21**
2.5	2,722	91	0.033	0.967	**90.19**
3.5	2,559	93	0.037	0.963	**87.19**
4.5	2,404	100	0.042	0.958	**84.01**
5.5	1,986	95	0.048	0.952	**80.50**
6.5	1,581	91	0.058	0.942	**76.67**
7.5	1,201	82	0.068	0.932	**72.26**
8.5	847	71	0.084	0.916	**67.31**
9.5	536	59	0.110	0.890	**61.63**
10.5	297	43	0.143	0.857	**54.87**
11.5	131	23	0.172	0.828	**47.01**
					38.91
Total	23,268	1,052			

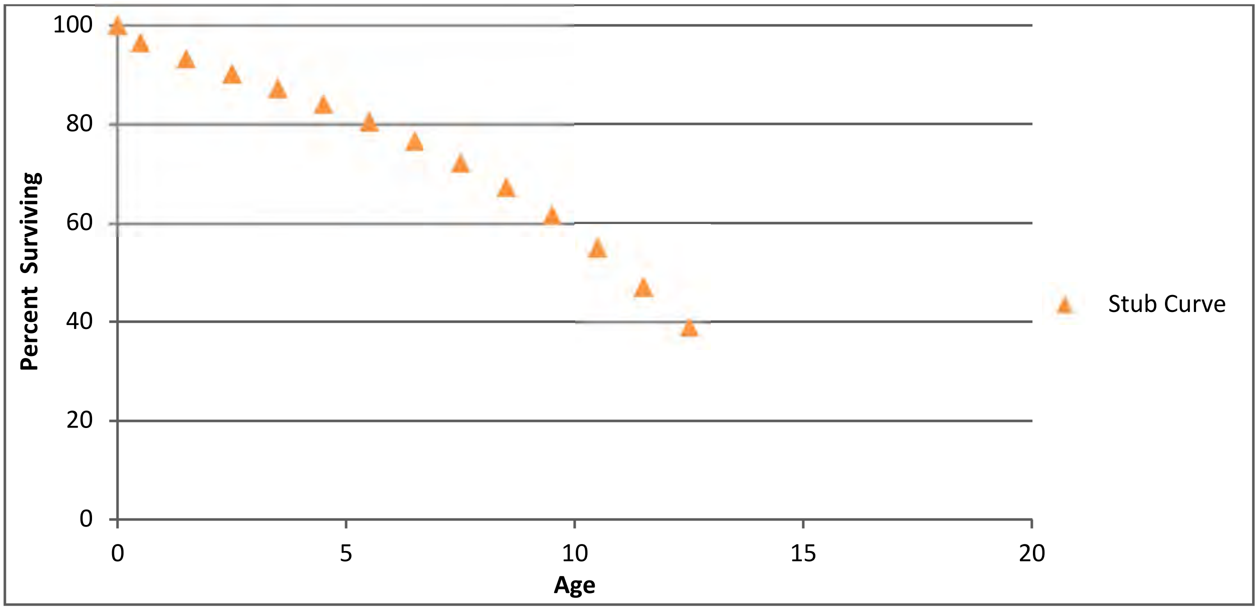
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. For example, the percent surviving at the start of age interval 1.5 is 93.21%, which was calculated by multiplying the percent surviving for age interval 0.5 (96.43%) by the survivor ratio for age interval 0.5 (0.967)[97].

The percentages surviving in Column F are the numbers that are used to form the original survivor curve. This particular curve starts at 100% surviving and ends at 38.91% surviving. An

[97] Multiplying 96.43 by 0.967 does not equal 93.21 exactly due to rounding.

observed survivor curve such as this that does not reach zero percent surviving is called a "stub" curve. The figure below illustrates the stub survivor curve derived from the OLT above.

Figure 21:
Original "Stub" Survivor Curve



The matrices used to develop the basic OLT and stub survivor curve provide a basic illustration of the retirement rate method in that only a few placement and experience years were used. In reality, analysts may have several decades of aged property data to analyze. In that case, it may be useful to use a technique called "banding" in order to identify trends in the data.

<u>Banding</u>

The forces of retirement and characteristics of industrial property are constantly changing. A depreciation analyst may examine the magnitude of these changes. Analysts often use a technique called "banding" to assist with this process. Banding refers to the merging of several years of data into a single data set for further analysis, and it is a common technique associated with the retirement rate method.[98] There are three primary benefits of using bands in depreciation analysis:

1. Increasing the sample size. In statistical analyses, the larger the sample size in relation to the body of total data, the greater the reliability of the result;

2. Smooth the observed data. Generally, the data obtained from a single activity or vintage year will not produce an observed life table that can be easily fit; and

3. Identify trends. By looking at successive bands, the analyst may identify broad trends in the data that may be useful in projecting the future life characteristics of the property.[99]

Two common types of banding methods are the “placement band” method and the “experience band” method.” A placement band, as the name implies, isolates selected placement years for analysis. The figure below illustrates the same exposure matrix shown above, except that only the placement years 2005-2008 are considered in calculating the total exposures at the beginning of each age interval.

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[98] NARUC *supra* n. 10, at 113.

[99] *Id*.

Figure 22:
Placement Bands

Placement Years	Experience Years Exposures at January 1 of Each Year (Dollars in 000's) 2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	198	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	471	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	788	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,133	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,186	5.5 - 6.5
2010			381	369	358	347	336	327	1,237	4.5 - 5.5
2011				386	372	359	346	334	1,285	3.5 - 4.5
2012					395	380	366	352	1,331	2.5 - 3.5
2013						401	385	370	1,059	1.5 - 2.5
2014							410	393	733	0.5 - 1.5
2015								416	375	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,796	

The shaded cells within the placement band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same placement band would be used for the retirement matrix covering the same placement years of 2005 – 2008. This of course would result in a different OLT and original stub survivor curve than those that were calculated above without the restriction of a placement band.

Analysts often use placement bands for comparing the survivor characteristics of properties with different physical characteristics.[100] Placement bands allow analysts to isolate the effects of changes in technology and materials that occur in successive generations of plant. For example, if in 2005 an electric utility began placing transmission poles into service with a special chemical treatment that extended the service lives of those poles, an analyst could use placement bands to isolate and analyze the effect of that change in the property group's physical characteristics. While

[100] Wolf *supra* n. 9, at 182.

placement bands are very useful in depreciation analysis, they also possess an intrinsic dilemma. A fundamental characteristic of placement bands is that they yield fairly complete survivor curves for older vintages. However, with newer vintages, which are arguably more valuable for forecasting, placement bands yield shorter survivor curves. Longer "stub" curves are considered more valuable for forecasting average life. Thus, an analyst must select a band width broad enough to provide confidence in the reliability of the resulting curve fit yet narrow enough so that an emerging trend may be observed.[101]

Analysts also use "experience bands." Experience bands show the composite retirement history for all vintages during a select set of activity years. The figure below shows the same data presented in the previous exposure matrices, except that the experience band from 2011 – 2013 is isolated, resulting in different interval totals.

[101] NARUC *supra* n. 10, at 114.

Figure 23:
Experience Bands

Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
	Experience Years Exposures at January 1 of Each Year (Dollars in 000's)									
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	173	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	376	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	645	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	752	6.5 - 7.5
2009		377	366	356	346	336	327	319	872	5.5 - 6.5
2010			381	369	358	347	336	327	959	4.5 - 5.5
2011				386	372	359	346	334	1,008	3.5 - 4.5
2012					395	380	366	352	1,039	2.5 - 3.5
2013						401	385	370	1,072	1.5 - 2.5
2014							410	393	1,121	0.5 - 1.5
2015								416	1,182	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,199	

The shaded cells within the experience band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same experience band would be used for the retirement matrix covering the same experience years of 2011 – 2013. This of course would result in a different OLT and original stub survivor than if the band had not been used. Analysts often use experience bands to isolate and analyze the effects of an operating environment over time.[102] Likewise, the use of experience bands allows analysis of the effects of an unusual environmental event. For example, if an unusually severe ice storm occurred in 2013, destruction from that storm would affect an electric utility's line transformers of all ages. That is, each of the line transformers from each placement year would be affected, including those recently installed in 2012, as well as those installed in 2003. Using experience bands, an analyst could isolate or even eliminate the 2013 experience year from the analysis. In contrast, a placement band would not effectively isolate the

[102] *Id.*

ice storm's effect on life characteristics. Rather, the placement band would show an unusually large rate of retirement during 2013, making it more difficult to accurately fit the data with a smooth Iowa curve. Experience bands tend to yield the most complete stub curves for recent bands because they have the greatest number of vintages included. Longer stub curves are better for forecasting. The experience bands, however, may also result in more erratic retirement dispersion making the curve fitting process more difficult.

Depreciation analysts must use professional judgment in determining the types of bands to use and the band widths. In practice, analysts may use various combinations of placement and experience bands in order to increase the data sample size, identify trends and changes in life characteristics, and isolate unusual events. Regardless of which bands are used, observed survivor curves in depreciation analysis rarely reach zero percent. This is because, as seen in the OLT above, relatively newer vintage groups have not yet been fully retired at the time the property is studied. An analyst could confine the analysis to older, fully retired vintage groups to get complete survivor curves, but such analysis would ignore some of the property currently in service and would arguably not provide an accurate description of life characteristics for current plant in service. Because a complete curve is necessary to calculate the average life of the property group, however, curve fitting techniques using Iowa curves or other standardized curves may be employed in order to complete the stub curve.

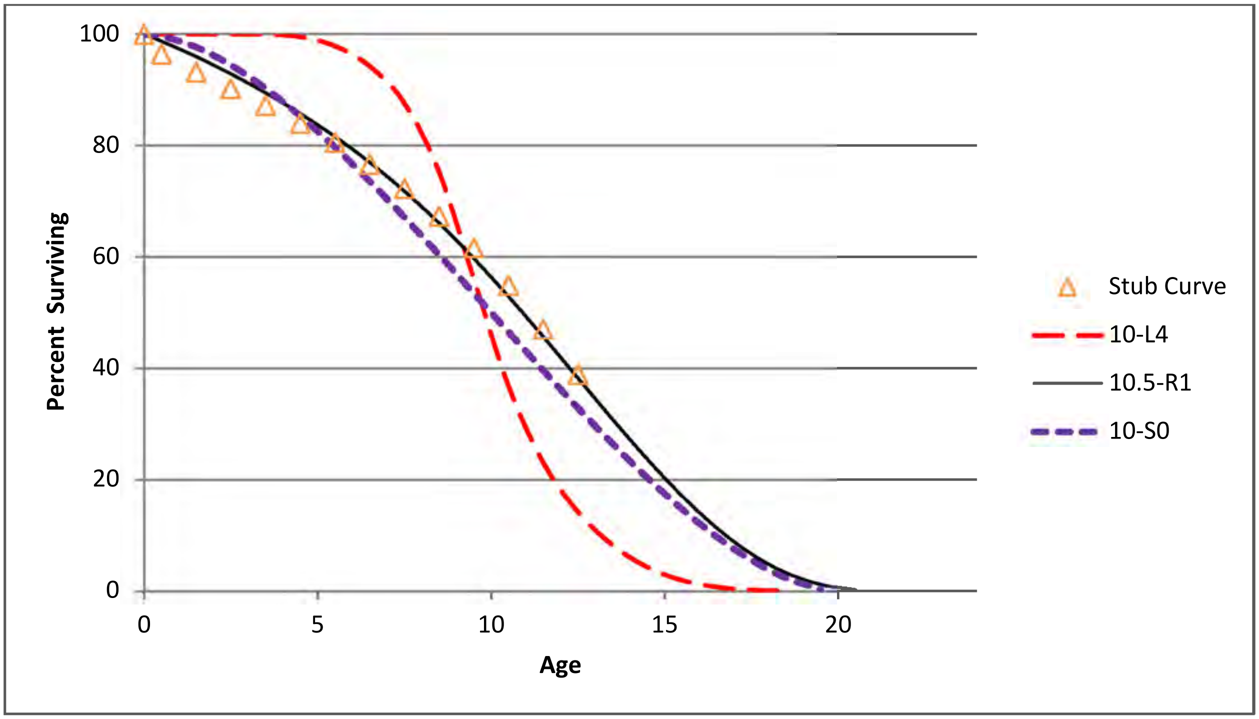
Curve Fitting

Depreciation analysts typically use the survivor curve rather than the frequency curve to fit the observed stub curves. The most commonly used generalized survivor curves in the curve fitting process are the Iowa curves discussed above. As Wolf notes, if "the Iowa curves are adopted as a model, an underlying assumption is that the process describing the retirement pattern is one of the 22 [or more] processes described by the Iowa curves."[103]

Curve fitting may be done through visual matching or mathematical matching. In visual curve fitting, the analyst visually examines the plotted data to make an initial judgment about the Iowa curves that may be a good fit. The figure below illustrates the stub survivor curve shown above. It also shows three different Iowa curves: the 10-L4, the 10.5-R1, and the 10-S0. Visually, it is clear that the 10.5-R1 curve is a better fit than the other two curves.

[103] Wolf *supra* n. 9, at 46 (22 curves includes Winfrey's 18 original curves plus Cowles's four "O" type curves).

Figure 24:
Visual Curve Fitting



In mathematical fitting, the least squares method is used to calculate the best fit. This mathematical method would be excessively time consuming if done by hand. With the use of modern computer software however, mathematical fitting is an efficient and useful process. The typical logic for a computer program, as well as the software employed for the analysis in this testimony is as follows:

> First (an Iowa curve) curve is arbitrarily selected. . . . If the observed curve is a stub curve, . . . calculate the area under the curve and up to the age at final data point. Call this area the realized life. Then systematically vary the average life of the theoretical survivor curve and calculate its realized life at the age corresponding to the study date. This trial and error procedure ends when you find an average life such that the realized life of the theoretical curve equals the realized life of the observed curve. Call this the average life.
>
> Once the average life is found, calculate the difference between each percent surviving point on the observed survivor curve and the corresponding point on the Iowa curve. Square each difference and sum them. The sum of squares is used as a measure of goodness of fit for that particular Iowa type curve. This procedure is

> repeated for the remaining 21 Iowa type curves. The “best fit” is declared to be the type of curve that minimizes the sum of differences squared.[104]

Mathematical fitting requires less judgment from the analyst and is thus less subjective. Blind reliance on mathematical fitting, however, may lead to poor estimates. Thus, analysts should employ both mathematical and visual curve fitting in reaching their final estimates. This way, analysts may utilize the objective nature of mathematical fitting while still employing professional judgment. As Wolf notes: “The results of mathematical curve fitting serve as a guide for the analyst and speed the visual fitting process. But the results of the mathematical fitting should be checked visually, and the final determination of the best fit be made by the analyst.”[105]

In the graph above, visual fitting was sufficient to determine that the 10.5-R1 Iowa curve was a better fit than the 10-L4 and the 10-S0 curves. Using the sum of least squares method, mathematical fitting confirms the same result. In the chart below, the percentages surviving from the OLT that formed the original stub curve are shown in the left column, while the corresponding percentages surviving for each age interval are shown for the three Iowa curves. The right portion of the chart shows the differences between the points on each Iowa curve and the stub curve. These differences are summed at the bottom. Curve 10.5-R1 is the best fit because the sum of the squared differences for this curve is less than the same sum for the other two curves. Curve 10-L4 is the worst fit, which was also confirmed visually.

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[104] Wolf *supra* n. 9, at 47.

[105] *Id*. at 48.

Figure 25:
Mathematical Fitting

Age Interval	Stub Curve	Iowa Curves 10-L4	Iowa Curves 10-S0	Iowa Curves 10.5-R1	Squared Differences 10-L4	Squared Differences 10-S0	Squared Differences 10.5-R1
0.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
0.5	96.4	100.0	99.7	98.7	12.7	10.3	5.3
1.5	93.2	100.0	97.7	96.0	46.1	19.8	7.6
2.5	90.2	100.0	94.4	92.9	96.2	18.0	7.2
3.5	87.2	100.0	90.2	89.5	162.9	9.3	5.2
4.5	84.0	99.5	85.3	85.7	239.9	1.6	2.9
5.5	80.5	97.9	79.7	81.6	301.1	0.7	1.2
6.5	76.7	94.2	73.6	77.0	308.5	9.5	0.1
7.5	72.3	87.6	67.1	71.8	235.2	26.5	0.2
8.5	67.3	75.2	60.4	66.1	62.7	48.2	1.6
9.5	61.6	56.0	53.5	59.7	31.4	66.6	3.6
10.5	54.9	36.8	46.5	52.9	325.4	69.6	3.9
11.5	47.0	23.1	39.6	45.7	572.6	54.4	1.8
12.5	38.9	14.2	32.9	38.2	609.6	36.2	0.4
SUM					**3004.2**	**371.0**	**41.0**

APPENDIX D:

SIMULATED LIFE ANALYSIS

Aged data is required to perform actuarial analysis. That is, the collection of property data must contain the dates of placements, retirements, transfers, and other actions. When a utility's property records do not contain aged data, however, analysts may use another analytical method to simulate the missing data. The contrast between aged and unaged data is illustrated in the matrices below.[106] The first matrix is similar to the matrices in Appendix C used to demonstrate actuarial analysis.

Figure 26:
Aged Data Matrix

End of Year Balances ($)										
Vintage	Installations	1997	1999	2001	2003	2005	2007	2009	2011	2013
1997	220	220	220	220	213	194	152	95	19	0
			250	250	248	235	198	143	31	4
1999	270		270	270	270	262	238	186	57	9
				285	285	282	268	225	91	26
2001	300			300	300	300	291	264	145	42
					320	320	317	301	241	103
2003	350				350	350	350	340	284	157
						375	375	371	325	219
2005	390					390	390	390	362	286
							405	405	392	344
2007	450						450	450	441	416
								480	480	478
2009	500							500	500	500
									580	580
2011	670								670	670
										790
2013	750									750
Balance		220	740	1325	1986	2708	3434	4150	4618	5374

[106] See SDP Fundamentals 2014 pdf. 152.

The aged data matrix contains installation or "vintage" years in the first column and experience years in the top row. (Only every other year is shown in order to save space). This matrix contains aged data, meaning that the utility kept track of the age of plant when it was retired. In 2007, for example, $291 were remaining in service from the 2001 installation of $300. Likewise, in 2011, it was known that $57 were remaining in service from the 1999 vintage installation of $270. The amounts in each experience year column are added to arrive the year-end balances. Now assume that the amount of installations and retirements are the same for each year, but that the utility did not keep track of the age of plant when it was retired. The data matrix below contains the same data, except it is not aged. Thus, while the year-end balances are the same, the amount retired from each vintage in a given year is unknown.

Figure 27:
Unaged Data Matrix

		End of Year Balances ($)								
Vintage	Installations	1997	1999	2001	2003	2005	2007	2009	2011	2013
1997	220									
1999	270									
2001	300									
2003	350									
2005	390									
2007	450									
2009	500									
2011	670									
2013	750									
Balance		220	740	1325	1986	2708	3434	4150	4618	5374

Thus, in 2007, the company still had a year-end balance $3,434, but it is unknown how much of this amount surviving is attributable to each vintage group of property.

The method that depreciation analysts use to examine unaged data is called the "simulated plant record" method ("SPR").[107] The SPR method is used to simulate the retirement pattern for each vintage and to indicate the Iowa curve that best represent the life characteristics of the property being analyzed.[108] In other words, the SPR model may be used to "fill in" the unaged data matrix with simulated vintage balances for each experience year. The SPR model assumes that all vintages' additions retire in accordance with the same retirement pattern.[109]

Unlike with actuarial analysis, which indicates the best fitting Iowa curve type based on the input data, the SPR model requires the analyst or computer program to first choose an Iowa curve and test the results. This process is repeated until the analyst finds the curve that best matches the observed data is found.[110] Although the SPR method may be conducted manually, analysts typically rely on computer programs to make the process more efficient.

In the example presented below, the best fitting curve is the one that most closely simulates the actual balance of $4,150 for 2009. The chart below compares the actual and simulated vintage balances for the 2009 experience year using an Iowa 10-S3 curve. The 2009 simulated balances using the 10-S3 curve produce a year-end balance of $3,775. The actual balance, however, is

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[107] Wolf 220. Cyrus Hill is generally credited with developing the principles used in the SPR method. In 1947, Alex Bauhan expanded the SPR method and developed several criteria used to measure the accuracy of simulated data, which he called the SPR method (See Bauhan, A. E., "Life Analysis of Utility Plant for Depreciation Accounting Purposes by the Simulated Plant Record Method," 1947, Appendix of the EEl, 1952.)

[108] NARUC *supra* n. 8, at 106.

[109] *Id*. at 107.

[110] Wolf 222.

$4,150. Thus, the 10-S3 curve produces a simulated balance that is $375 short of the actual balance.

Figure 28:
SPR Calculation Using Iowa Curve 10-S3

Age Interval	Vintage Year	Installations	10-S3 % Surviving	Sim. Bal. 2009
12.5	1997	220	16	35
11.5	1998	250	28	69
10.5	1999	270	42	114
9.5	2000	285	58	165
8.5	2001	300	72	217
7.5	2002	320	84	269
6.5	2003	350	92	323
5.5	2004	375	97	363
4.5	2005	390	99	386
3.5	2006	405	100	404
2.5	2007	450	100	450
1.5	2008	480	100	480
0.5	2009	500	100	500
	Total Simulated Balance			3,775
	Total Actual Balance			4,150
	Difference			(375)

The process is repeated with another curve until the best fitting curve is found. Specifically, a curve with a longer average life should be chosen in order to increase the simulated balance. For this example, the 12-S3 curve produces a perfect fit for 2009, as shown in the figure below.

Figure 29:
SPR Calculation Using Iowa Curve 12-S3

Age Interval	Vintage Year	Installations	12-S3 % Surviving	Sim. Bal. 2009
12.5	1997	220	43	95
11.5	1998	250	57	143
10.5	1999	270	69	186
9.5	2000	285	79	225
8.5	2001	300	88	264
7.5	2002	320	94	301
6.5	2003	350	97	340
5.5	2004	375	99	371
4.5	2005	390	100	390
3.5	2006	405	100	405
2.5	2007	450	100	450
1.5	2008	480	100	480
0.5	2009	500	100	500
		Total Simulated Balance		4,150
		Total Actual Balance		4,150
		Difference		0

It is not a coincidence that there was an Iowa curve that produced a perfect fit. This is because when only one year is tested under the SPR model, there is always an Iowa curve that will produce a perfect simulation. Thus, it is important that more than one year is tested. The figures below will demonstrate that even though a particular curve may have fit perfectly for one test year, it may not necessarily be the best choice when multiple years are tested. The chart below shows the results of the Iowa 12-S3 curve when 2009, 2011, and 2013 are tested.

Figure 30:
SPR: Curve 12-S3: 2009, 2011, 2013

Vintage	Insts.	% Surv.	2009	% Surv.	2011	% Surv.	2013
1997	220	43	95	21	46	6	13
1998	250	57	143	31	78	12	30
1999	270	69	186	43	116	21	57
2000	285	79	225	57	162	31	88
2001	300	88	264	69	207	43	129
2002	320	94	301	79	253	57	182
2003	350	97	340	88	308	69	242
2004	375	99	371	94	353	79	296
2005	390	100	390	97	378	88	343
2006	405	100	405	99	401	94	381
2007	450	100	450	100	450	97	437
2008	480	100	480	100	480	99	475
2009	500	100	500	100	500	100	500
2010	580			100	580	100	580
2011	670			100	670	100	670
2012	790					100	790
2013	750					100	750
Simulated Balances			$ 4,150		$ 4,982		$ 5,963
Actual Balances			4,150		4,618		5,374
Difference			0		364		589
Difference Squared			0		132,496		346,921

SSD = 479,417 **MSD = 159,806** **√MSD = 400**

$$CI = \frac{\text{Average Actual Bal}}{\sqrt{MSD}} = \frac{4{,}714}{400} = \mathbf{12} \qquad IV = \frac{1000}{CI} = \mathbf{85}$$

While the 12-S3 curve provided a perfect simulation for 2009, it did not for years 2011 and 2013 because the life characteristics were different in these years. Since the 12-S3 curve produced simulated balances that were greater than the actual balances, a curve with a shorter average life should be analyzed. The figure below shows the SPR results from the same test years using an Iowa 10-S3 curve.

Figure 31:
SPR: Curve 10-S3: 2009, 2011, 2013

Vintage	Insts.	% Surv.	2009	% Surv.	2011	% Surv.	2013
1997	220	16	35	3	7	0	0
1998	250	28	70	8	20	1	3
1999	270	42	113	16	43	3	8
2000	285	58	165	28	80	8	23
2001	300	72	216	42	126	16	48
2002	320	84	269	58	186	28	90
2003	350	92	322	72	252	42	147
2004	375	97	364	84	315	58	218
2005	390	99	386	92	359	72	281
2006	405	100	405	97	393	84	340
2007	450	100	450	99	446	92	414
2008	480	100	480	100	480	97	466
2009	500	100	500	100	500	99	495
2010	580			100	580	100	580
2011	670			100	670	100	670
2012	790					100	790
2013	750					100	750
Simulated Balances			$ 3,775		$ 4,457		$ 5,323
Actual Balances			4,150		4,618		5,374
Difference			(375)		(161)		(51)
Difference Squared			140,625		25,921		2,601

SSD = 169,147 **MSD = 56,382** **√MSD = 237**

CI = Average Actual Bal / √MSD = 4,714 / 237 = **20** **IV =** 1000 / CI = **50**

The 10-S3 curve resulted in a better fit than the 12-S3 curve, despite the fact that the 12-S3 provided a perfect fit for one year. Several useful tools to measure the accuracy of SPR results in discussed below.

There are several indices used to measure the fit of the chosen curve. Alex Bauhan developed the conformance index ("CI") to rank the optimal curves.[111] The CI is the average observed plant balance for the tested years, divided by the square root of the average sum of squared differences between the simulated and actual balances. The formula for the CI is shown below.

Equation 6:
Conformance Index

$$Conformance\ Index\ = \frac{Average\ of\ Actual\ Balances}{\sqrt{Average\ of\ Sum\ of\ Squared\ Differences}}$$

The previous figure above demonstrates the CI calculation. The difference between the actual and simulated balances was $375 in 2009, $161 in 2011, and $51 in 2013. The sum of these differences squared ("SSD") is 169,147 and the average of the SSD is 56,382 ("MSD"). The square root of the MSD is 237. The CI is the average of the three actual balances ($4,714) divided by 237, which equals 20. Bauhan proposed a scaled for measuring the value of the CI, which is shown below.

Figure 32:
Conformance Index Scale

CI	Value
> 75	Excellent
50 – 75	Good
25 – 50	Fair
< 25	Poor

[111] Bauhan, A. E., "Life Analysis of Utility Plant for Depreciation Accounting Purposes by the Simulated Plant Record Method," 1947, Appendix of the EEl, 1952.

Thus, the CI of 20 calculated above indicates that the 12-S3 curve is a poor fit. According to Bauhan, any CI value less than 50 would be considered unsatisfactory.[112]

A related measure to the CI is the "index of variation" ("IV").[113] The IV is equal to 1,000 divided by the CI, as shown in the Figures above. Although the IV does not use a definite scale like the CI, it follows that the highest-ranking curves are those with the lowest IVs. When divided by ten, the IV approximates the average difference between simulated and actual balances expressed as a percent of the average actual balance.[114] The IV resulting from the 12-S3 curve is 85, while the IV from the 10-S3 is 50, as shown above.

Another important statistical measure is the "retirements experience index" ("REI"), which measures the maturity of the account.[115] According to Bauhan, the CI alone cannot truly measure the validity of the chosen curve because the CI provides no indication of the sufficiency of the retirement experience.[116] A small REI implies that the history of the account may be too short to determine a best fitting Iowa curve. In other words, there may be many potential Iowa curves that could be fitted to a stub curve that is too short. This concept is illustrated in the graph below. This graph shows a stub survivor curve (the diamond-shaped points on the graph). The first seven data points of the stub survivor curve represent a small REI score. If an analyst was looking at only the first seven data points, it appears that several Iowa curves would provide a good fit, including the 10-S1, 8-L3, and 8-R3 (and several others not shown on the graph). These curves, however, have

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[112] SDP pdf. 210.

[113] White, R.E. and H. A. Cowles, "A Test Procedure for the Simulated Plant Record Method of Life Analysis," Journal of the American Statistical Association, vol. 70 (1970): 1204-1212.

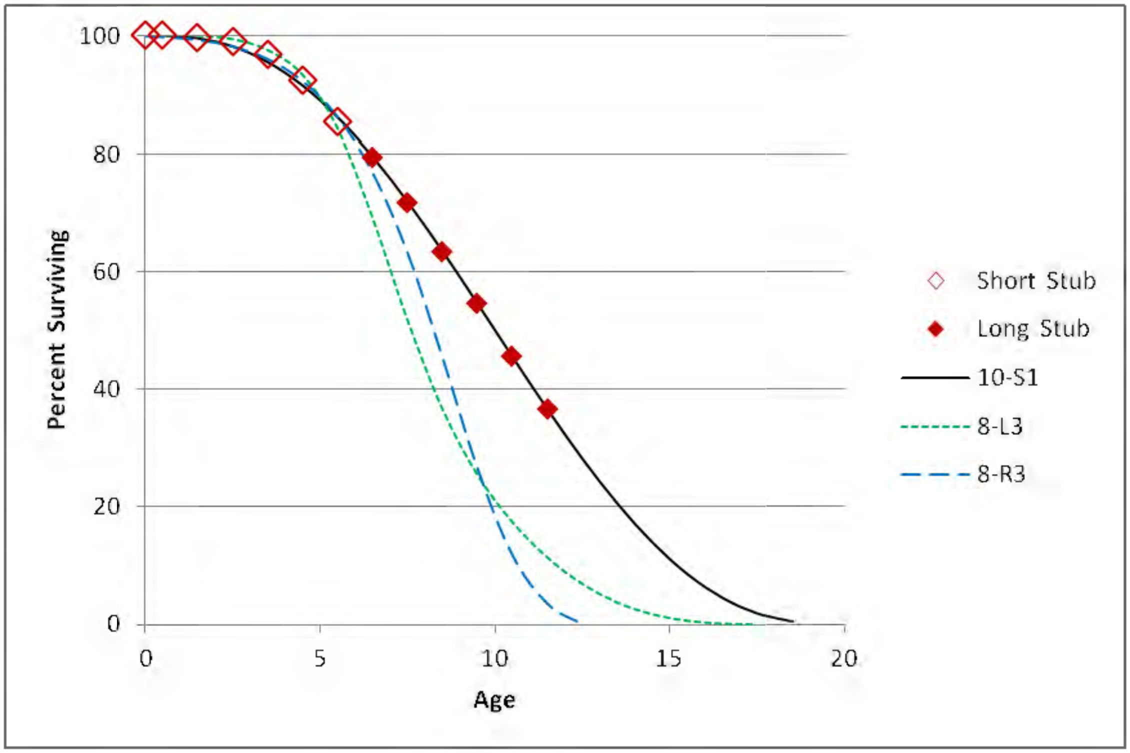
[114] NARUC supra n. 8 at 111.

[115] *See* SDP 210.

[116] SDP 210.

significantly different life characteristics and average lives. Once the longer stub curve is considered, it is obvious that the 10-S1 curve provides the best fit.

Figure 33:
REI Illustration



Although the REI only applies to simulated analysis, the concept that a longer stub curve provides for better-fitting Iowa curves also applies to actuarial analysis.

The REI is mathematically calculated by dividing the balance from the oldest vintage in the test year at the end of the year by the initial installation amount. Referring to the top row of the SPR figure above, there were $220 of installations in 1997, and only $13 remaining in 2013. The REI for this account using the 12-S3 curve would be 94% (1 – (13/220)). An REI of 100% indicates that a complete curve was used in the simulation.

As with the CI, Bauhan also proposed a scale for the REI, as shown in the figure below. Thus, the REI of 94% from the account above using the 12-S3 curve would be considered excellent. This makes sense because the oldest vintage from that account had been nearly fully retired in the final test year.

Figure 34:
REI Scale

REI	**Value**
> 75%	Excellent
50% – 75%	Good
33% – 50%	Fair
17% – 33%	Poor
0% – 17%	Valueless

Both the REI and CI, however, must be considered when assessing the value of an Iowa curve under the SPR method. So, while the REI of 94% is excellent, the same curve (12-S3) produced a CI of only 12, which is poor. According to Bauhan, in order for a curve to be considered entirely satisfactory, both the REI and CI should be "Good" or better (i.e., both above 50).

Summary Accrual Adjustment

	[1]	[2]	[3]	[4]
Plant Function	Plant Balance 12/31/2020	I&M Proposed Accrual	OUCC Proposed Accrual	**OUCC Accrual Adjustment**
Production	$ 4,712,321,073	$ 262,360,492	$ 261,704,090	$ (656,402)
Transmission	1,681,050,133	44,835,980	42,476,682	(2,359,298)
Distribution - IN	2,081,061,734	65,338,424	49,515,629	(15,822,795)
General	163,063,321	6,527,140	6,527,140	0
Total Plant Studied	$ 8,637,496,261	$ 379,062,036	$ 360,223,541	**$ (18,838,495)**

[1], [2] From depreciation study

[3] From Attachment DJG-2-4

[4] = [3] - [2]

Depreciation Parameter Comparison

Account		I&M Proposal				OUCC Proposal			
		Iowa Curve		Depr	Annual	Iowa Curve		Depr	Annual
No.	Description	Type	AL	Rate	Accrual	Type	AL	Rate	Accrual
	TRANSMISSION PLANT								
354.00	Towers & Fixtures	R5	66	2.85%	6,559,865	R4	75	2.08%	4,782,411
355.00	Poles & Fixtures	L0.5	50	3.40%	7,070,149	L0.5	54	3.12%	6,488,305
	DISTRIBUTION PLANT								
364.00	Poles, Towers, & Fixtures	L0	41	4.28%	10,782,708	L0	54	3.11%	7,850,320
365.00	OH Conductor & Devices	L0	39	2.86%	11,429,020	L0	48	2.26%	9,027,570
366.00	Underground Conduit	R2	60	1.66%	2,401,933	R2	71	1.37%	1,978,841
367.00	Underground Conductor	R2.5	54	1.96%	5,008,409	R1	60	1.65%	4,223,480
368.00	Line Transformers	R0.5	27	3.42%	10,885,354	R0.5	43	1.88%	5,988,968
369.00	Services	R0.5	44	2.65%	4,412,730	R0.5	56	1.95%	3,251,382
370.00	Meters	SQ	15	10.08%	7,710,539	L0	16	5.87%	4,487,339

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			I&M Proposal		OUCC Proposal		Difference	
Account No.	Description	Plant 12/31/2020	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	STEAM PRODUCTION PLANT							
	Rockport Unit 1							
311.00	Structures & Improvements	103,081,792	9.19%	9,470,443	9.13%	9,407,023	-0.06%	-63,420
312.00	Boiler Plant Equipment	646,499,630	9.90%	63,995,026	9.84%	63,591,373	-0.06%	-403,653
314.00	Turbogenerator Units	110,198,824	9.82%	10,824,210	9.76%	10,754,891	-0.06%	-69,319
315.00	Accessory Electrical Equipment	60,038,956	9.10%	5,465,835	9.04%	5,428,693	-0.06%	-37,142
316.00	Miscellaneous Power Plant Equip.	17,952,020	9.67%	1,736,276	9.61%	1,725,005	-0.06%	-11,271
	Total	937,771,222	9.76%	91,491,790	9.69%	90,906,985	-0.06%	-584,805
	Total Steam Production Plant	937,771,222	9.76%	91,491,790	9.69%	90,906,985	-0.06%	-584,805
	NUCLEAR PRODUCTION PLANT							
	Cook Unit 1							
321.00	Structures & Improvements	86,734,372	3.60%	3,125,355	3.60%	3,125,355	0.00%	0
322.00	Reactor Plant Equipment	782,729,686	4.87%	38,123,223	4.87%	38,123,223	0.00%	0
323.00	Turbogenerator Units	312,897,355	5.43%	17,003,166	5.43%	17,003,166	0.00%	0
324.00	Accessory Electrical Equipment	137,248,173	4.35%	5,970,618	4.35%	5,970,618	0.00%	0
325.00	Miscellaneous Power Plant Equip.	36,218,603	4.71%	1,705,971	4.71%	1,705,971	0.00%	0
	Total	1,355,828,189	4.86%	65,928,332	4.86%	65,928,332	0.00%	0
	Cook Unit 2							
321.00	Structures & Improvements	378,680,285	3.61%	13,687,067	3.61%	13,687,067	0.00%	0
322.00	Reactor Plant Equipment	1,053,868,998	4.33%	45,620,447	4.33%	45,620,447	0.00%	0
323.00	Turbogenerator Units	425,843,325	5.06%	21,530,145	5.06%	21,530,145	0.00%	0
324.00	Accessory Electrical Equipment	200,678,427	4.23%	8,493,418	4.23%	8,493,418	0.00%	0
325.00	Miscellaneous Power Plant Equip.	248,016,731	4.19%	10,386,037	4.19%	10,386,037	0.00%	0
	Total	2,307,087,766	4.32%	99,717,114	4.32%	99,717,114	0.00%	0
	Total Nuclear Production Plant	3,662,915,955	4.52%	165,645,446	4.52%	165,645,446	0.00%	0

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			I&M Proposal		OUCC Proposal		Difference	
Account No.	Description	Plant 12/31/2020	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	HYDRAULIC PRODUCTION PLANT							
	Berrien Springs							
331.00	Structures & Improvements	696,548	4.12%	28,688	4.08%	28,410	-0.04%	-278
332.00	Reservoirs, Dams & Waterways	6,320,266	3.52%	222,196	3.48%	219,682	-0.04%	-2,514
333.00	Waterwheels, Turbines & Generators	8,386,954	3.88%	325,533	3.84%	322,150	-0.04%	-3,384
334.00	Accessory Electrical Equip.	1,417,718	3.75%	53,207	3.71%	52,628	-0.04%	-579
335.00	Misc. Power Plant Equip.	929,404	4.06%	37,777	4.02%	37,404	-0.04%	-373
	Total	17,750,890	3.76%	667,402	3.72%	660,274	-0.04%	-7,128
	Buchanan							
331.00	Structures & Improvements	660,195	4.15%	27,377	4.01%	26,505	-0.13%	-872
332.00	Reservoirs, Dams & Waterways	5,154,683	3.36%	173,440	3.23%	166,663	-0.13%	-6,776
333.00	Waterwheels, Turbines & Generators	1,414,445	3.30%	46,670	3.17%	44,784	-0.13%	-1,886
334.00	Accessory Electrical Equip.	1,108,771	3.54%	39,231	3.40%	37,733	-0.14%	-1,498
335.00	Misc. Power Plant Equip.	311,833	4.15%	12,926	4.01%	12,513	-0.13%	-413
	Total	8,649,927	3.46%	299,643	3.33%	288,198	-0.13%	-11,446
	Elkhart							
331.00	Structures & Improvements	1,632,902	6.00%	97,918	5.89%	96,195	-0.11%	-1,723
332.00	Reservoirs, Dams & Waterways	11,027,557	6.49%	715,350	6.38%	703,760	-0.11%	-11,589
333.00	Waterwheels, Turbines & Generators	875,459	5.24%	45,896	5.14%	44,963	-0.11%	-933
334.00	Accessory Electrical Equip.	766,670	5.36%	41,108	5.25%	40,283	-0.11%	-826
335.00	Misc. Power Plant Equip.	342,337	7.30%	24,999	7.20%	24,636	-0.11%	-363
	Total	14,644,925	6.32%	925,270	6.21%	909,837	-0.11%	-15,433
	Twin Branch							
331.00	Structures & Improvements	1,428,784	4.66%	66,648	4.64%	66,340	-0.02%	-308
332.00	Reservoirs, Dams & Waterways	8,416,861	3.99%	335,807	3.97%	334,000	-0.02%	-1,807
333.00	Waterwheels, Turbines & Generators	9,909,128	4.27%	423,349	4.25%	421,191	-0.02%	-2,158
334.00	Accessory Electrical Equip.	2,876,083	4.21%	121,131	4.19%	120,496	-0.02%	-635
335.00	Misc. Power Plant Equip.	1,005,606	5.03%	50,606	5.01%	50,388	-0.02%	-218

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			I&M Proposal		OUCC Proposal		Difference	
Account No.	Description	Plant 12/31/2020	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	Total	23,636,462	4.22%	997,541	4.20%	992,416	-0.02%	-5,126
	Constantine							
331.00	Structures & Improvements	470,900	2.54%	11,958	2.27%	10,705	-0.27%	-1,253
332.00	Reservoirs, Dams & Waterways	1,653,789	2.44%	40,330	2.18%	35,980	-0.26%	-4,351
333.00	Waterwheels, Turbines & Generators	993,032	2.40%	23,832	2.13%	21,131	-0.27%	-2,701
334.00	Accessory Electrical Equip.	671,796	3.05%	20,511	2.77%	18,630	-0.28%	-1,881
335.00	Misc. Power Plant Equip.	475,641	3.08%	14,650	2.81%	13,375	-0.27%	-1,275
	Total	4,265,158	2.61%	111,281	2.34%	99,822	-0.27%	-11,460
	Mottville							
331.00	Structures & Improvements	797,060	4.64%	37,012	4.52%	36,042	-0.12%	-970
332.00	Reservoirs, Dams & Waterways	2,312,828	4.08%	94,320	3.96%	91,517	-0.12%	-2,803
333.00	Waterwheels, Turbines & Generators	639,576	3.87%	24,747	3.75%	23,963	-0.12%	-784
334.00	Accessory Electrical Equip.	772,571	4.56%	35,218	4.43%	34,262	-0.12%	-956
335.00	Misc. Power Plant Equip.	409,136	5.45%	22,293	5.33%	21,794	-0.12%	-499
336.00	Roads, Railroads & Bridges	902	3.15%	28	3.03%	27	-0.12%	-1
	Total	4,932,073	4.33%	213,618	4.21%	207,605	-0.12%	-6,013
	Crew Service Center							
331.00	Structures & Improvements	417,303	1.64%	6,829	1.62%	6,773	-0.01%	-56
335.00	Misc. Power Plant Equip.	126,865	1.62%	2,059	1.61%	2,042	-0.01%	-17
	Total	544,168	1.63%	8,888	1.62%	8,815	-0.01%	-74
	Total Hydraulic Production Plant	74,423,603	4.33%	3,223,644	4.26%	3,166,967	-0.08%	-56,678
	OTHER PRODUCTION PLANT							
	Deer Creek Solar Facility							
344.00	Generators	5,668,204	5.38%	304,821	5.30%	300,415	-0.08%	-4,406
345.00	Accessory Electric Equip.	720,502	6.57%	47,342	6.49%	46,782	-0.08%	-560

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			I&M Proposal		OUCC Proposal		Difference	
Account No.	Description	Plant 12/31/2020	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
346.00	Misc. Power Plant Equip.	10,893	7.11%	775	7.03%	766	-0.08%	-8
	Total	6,399,599	5.51%	352,938	5.44%	347,963	-0.08%	-4,974
	Olive Solar Facility							
341.00	Structures & Improvements	376,687	5.33%	20,088	5.28%	19,880	-0.06%	-208
344.00	Generators	11,184,837	5.33%	596,459	5.28%	590,276	-0.06%	-6,183
345.00	Accessory Electric Equip.	269,062	5.33%	14,348	5.28%	14,200	-0.06%	-149
346.00	Misc. Power Plant Equip.	215,250	5.33%	11,479	5.28%	11,360	-0.06%	-119
	Total	12,045,836	5.33%	642,374	5.28%	635,715	-0.06%	-6,659
	Twin Branch Solar Facility							
344.00	Generators	6,955,324	5.38%	374,511	5.44%	378,181	0.05%	3,670
	Total	6,955,324	5.38%	374,511	5.44%	378,181	0.05%	3,670
	Watervliet Facility							
341.00	Structures & Improvements	358,237	5.33%	19,104	5.27%	18,893	-0.06%	-211
344.00	Generators	11,107,366	5.33%	592,328	5.27%	585,785	-0.06%	-6,542
346.00	Misc. Power Plant Equip.	343,931	5.34%	18,358	5.28%	18,155	-0.06%	-203
	Total	11,809,534	5.33%	629,789	5.27%	622,833	-0.06%	-6,956
	Total Other Production Plant	37,210,293	5.37%	1,999,612	5.33%	1,984,692	-0.04%	-14,919
	Total Production Plant	**4,712,321,073**	**5.57%**	**262,360,492**	**5.55%**	**261,704,090**	**-0.01%**	**-656,402**
	TRANSMISSION PLANT							
350.10	Land Rights	62,292,873	1.76%	1,094,690	1.76%	1,094,690	0.00%	0
352.00	Structures & Improvements	52,265,232	1.76%	917,627	1.76%	917,627	0.00%	0
353.00	Station Equipment	826,489,176	2.68%	22,167,670	2.68%	22,167,670	0.00%	0
354.00	Towers & Fixtures	230,452,983	2.85%	6,559,865	2.08%	4,782,411	-0.77%	-1,777,454

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			I&M Proposal		OUCC Proposal		Difference	
Account No.	Description	Plant 12/31/2020	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
355.00	Poles & Fixtures	208,136,265	3.40%	7,070,149	3.12%	6,488,305	-0.28%	-581,844
356.00	OH Conductor & Devices	294,558,395	2.34%	6,880,786	2.34%	6,880,786	0.00%	0
357.00	Underground Conduit	2,241,687	2.25%	50,369	2.25%	50,369	0.00%	0
358.00	Underground Conductor	4,522,363	2.06%	93,289	2.06%	93,289	0.00%	0
359.00	Roads and Trails	91,159	1.68%	1,535	1.68%	1,535	0.00%	0
	Total Transmission Plant	**1,681,050,133**	**2.67%**	**44,835,980**	**2.53%**	**42,476,682**	**-0.14%**	**-2,359,298**
	DISTRIBUTION PLANT - INDIANA							
360.10	Land Rights	10,926,039	1.44%	157,646	1.44%	157,646	0.00%	0
361.00	Structures & Improvements	32,691,043	1.96%	641,289	1.96%	641,289	0.00%	0
362.00	Station Equipment	379,401,090	2.56%	9,718,860	2.56%	9,718,860	0.00%	0
363.00	Storage Battery Equipment	5,606,730	9.09%	509,494	9.09%	509,494	0.00%	0
364.00	Poles, Towers, & Fixtures	252,111,755	4.28%	10,782,708	3.11%	7,850,320	-1.16%	-2,932,388
365.00	Overhead Conductor & Devices	399,931,378	2.86%	11,429,020	2.26%	9,027,570	-0.60%	-2,401,450
366.00	Underground Conduit	144,882,340	1.66%	2,401,933	1.37%	1,978,841	-0.29%	-423,092
367.00	Underground Conductor	255,708,978	1.96%	5,008,409	1.65%	4,223,480	-0.31%	-784,930
368.00	Line Transformers	318,204,324	3.42%	10,885,354	1.88%	5,988,968	-1.54%	-4,896,386
369.00	Services	166,556,147	2.65%	4,412,730	1.95%	3,251,382	-0.70%	-1,161,348
370.00	Meters	76,493,447	10.08%	7,710,539	5.87%	4,487,339	-4.21%	-3,223,201
371.00	Installations on Custs. Prem.	20,434,795	4.90%	1,000,455	4.90%	1,000,455	0.00%	0
373.00	Street Lighting & Signal Sys.	18,113,668	3.75%	679,987	3.75%	679,987	0.00%	0
	Total Distribution Plant - Indiana	2,081,061,734	3.14%	65,338,424	2.38%	49,515,629	-0.76%	-15,822,795
	DISTRIBUTION PLANT - MICHIGAN							
360.10	Land Rights	6,056,743	1.44%	87,389	1.44%	87,389	0.00%	0
361.00	Structures & Improvements	4,510,462	1.96%	88,480	1.96%	88,480	0.00%	0
362.00	Station Equipment	96,403,578	2.56%	2,469,505	2.56%	2,469,505	0.00%	0
363.00	Storage Battery Equipment	0	9.09%	0	9.09%	0	0.00%	0
364.00	Poles, Towers, & Fixtures	80,503,822	4.28%	3,443,113	3.11%	2,506,749	-1.16%	-936,364
365.00	Overhead Conductor & Devices	139,323,640	2.86%	3,981,515	2.26%	3,144,924	-0.60%	-836,590
366.00	Underground Conduit	12,573,950	1.66%	208,457	1.37%	171,738	-0.29%	-36,719
367.00	Underground Conductor	37,852,912	1.96%	741,401	1.65%	625,207	-0.31%	-116,194
368.00	Line Transformers	52,380,639	3.42%	1,791,873	1.88%	985,863	-1.54%	-806,010

Detailed Rate Comparison

Account No.	Description	[1] Plant 12/31/2020	[2] I&M Proposal Rate	I&M Proposal Annual Accrual	[3] OUCC Proposal Rate	OUCC Proposal Annual Accrual	[4] Difference Rate	Difference Annual Accrual
369.00	Services	33,052,679	2.65%	875,696	1.95%	645,229	-0.70%	-230,467
370.00	Meters	22,239,359	10.08%	2,241,727	5.87%	1,304,629	-4.21%	-937,099
371.00	Installations on Custs. Prem.	8,344,653	4.90%	408,541	4.90%	408,541	0.00%	0
373.00	Street Lighting & Signal Sys.	5,882,009	3.75%	220,811	3.75%	220,811	0.00%	0
	Total Distribution Plant - Michigan	499,124,446	3.32%	16,558,508	2.54%	12,659,065	-0.78%	-3,899,443
	Total Distribution Plant	**2,580,186,180**	**3.17%**	**81,896,932**	**2.41%**	**62,174,694**	**-0.76%**	**-19,722,238**
	GENERAL PLANT							
390.00	Structures & Improvements	61,646,560	2.54%	1,566,820	2.54%	1,566,820	0.00%	0
391.00	Office Furniture & Equipment	5,869,860	5.47%	321,177	5.47%	321,177	0.00%	0
393.00	Stores Equipment	996,539	8.08%	80,488	8.08%	80,488	0.00%	0
394.00	Tools Shop & Garage Equipment	16,780,302	7.86%	1,318,642	7.86%	1,318,642	0.00%	0
395.00	Laboratory Equipment	240,988	6.44%	15,517	6.44%	15,517	0.00%	0
396.00	Power Operated Equipment	543,715	6.45%	35,068	6.45%	35,068	0.00%	0
397.00	Communication Equipment	66,159,303	4.21%	2,784,040	4.21%	2,784,040	0.00%	0
398.00	Miscellaneous Equipment	10,826,054	3.74%	405,387	3.74%	405,387	0.00%	0
	Total General Plant	**163,063,321**	**4.00%**	**6,527,140**	**4.00%**	**6,527,140**	**0.00%**	**0**
	TOTAL DEPRECIABLE PLANT	**$ 9,136,620,707**	**4.33%**	**$ 395,620,544**	**4.08%**	**$ 372,882,606**	**-0.25%**	**$ (22,737,938)**

[1], [2] From depreciation study
[3] From Attachment DJG-2-5
[4] = [3] - [2]

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Account		Plant	Iowa Curve		Net	Depreciable	Book	Future	Remaining	Service Life		Net Salvage		Total	
No.	Description	12/31/2020	Type	AL	Salvage	Base	Reserve	Accruals	Life	Accrual	Rate	Accrual	Rate	Accrual	Rate
	STEAM PRODUCTION PLANT														
	Rockport Unit 1														
311.00	Structures & Improvements	103,081,792			-1.7%	104,796,523	53,340,105	51,456,418	5.47	9,093,544	8.82%	313,479	0.30%	9,407,023	**9.13%**
312.00	Boiler Plant Equipment	646,499,630			-1.7%	657,253,931	314,496,432	342,757,499	5.39	61,596,141	9.53%	1,995,232	0.31%	63,591,373	**9.84%**
314.00	Turbogenerator Units	110,198,824			-1.7%	112,031,944	54,493,275	57,538,669	5.35	10,412,252	9.45%	342,639	0.31%	10,754,891	**9.76%**
315.00	Accessory Electrical Equipment	60,038,956			-1.7%	61,037,684	31,505,593	29,532,091	5.44	5,245,103	8.74%	183,590	0.31%	5,428,693	**9.04%**
316.00	Miscellaneous Power Plant Equip.	17,952,020			-1.7%	18,250,646	9,004,621	9,246,025	5.36	1,669,291	9.30%	55,714	0.31%	1,725,005	**9.61%**
	Total	937,771,222			-1.7%	953,370,727	462,840,026	490,530,701	5.40	88,016,331	9.39%	2,890,654	0.31%	90,906,985	**9.69%**
	Total Steam Production Plant	937,771,222			-1.7%	953,370,727	462,840,026	490,530,701	5.40	88,016,331	9.39%	2,890,654	0.31%	90,906,985	**9.69%**
	NUCLEAR PRODUCTION PLANT														
	Cook Unit 1														
321.00	Structures & Improvements	86,734,372			-1.0%	87,601,716	52,347,711	35,254,005	11.28	3,048,463	3.51%	76,892	0.09%	3,125,355	**3.60%**
322.00	Reactor Plant Equipment	782,729,686			-3.0%	806,211,577	388,762,289	417,449,288	10.95	35,978,758	4.60%	2,144,465	0.27%	38,123,223	**4.87%**
323.00	Turbogenerator Units	312,897,355			-3.0%	322,284,276	144,601,188	177,683,088	10.45	16,104,896	5.15%	898,270	0.29%	17,003,166	**5.43%**
324.00	Accessory Electrical Equipment	137,248,173			0.0%	137,248,173	70,795,200	66,452,973	11.13	5,970,618	4.35%	0	0.00%	5,970,618	**4.35%**
325.00	Miscellaneous Power Plant Equip.	36,218,603			0.0%	36,218,603	17,504,106	18,714,497	10.97	1,705,971	4.71%	0	0.00%	1,705,971	**4.71%**
	Total	1,355,828,189			-2.5%	1,389,564,344	674,010,494	715,553,850	10.85	62,808,705	4.63%	3,119,627	0.23%	65,928,332	**4.86%**
	Cook Unit 2														
321.00	Structures & Improvements	378,680,285			-2.0%	386,253,891	192,581,892	193,671,999	14.15	13,151,830	3.47%	535,237	0.14%	13,687,067	**3.61%**
322.00	Reactor Plant Equipment	1,053,868,998			-3.0%	1,085,485,068	464,134,580	621,350,488	13.62	43,299,150	4.11%	2,321,297	0.22%	45,620,447	**4.33%**
323.00	Turbogenerator Units	425,843,325			-4.0%	442,877,058	166,645,297	276,231,761	12.83	20,202,496	4.74%	1,327,649	0.31%	21,530,145	**5.06%**
324.00	Accessory Electrical Equipment	200,678,427			0.0%	200,678,427	82,534,984	118,143,443	13.91	8,493,418	4.23%	0	0.00%	8,493,418	**4.23%**
325.00	Miscellaneous Power Plant Equip.	248,016,731			0.0%	248,016,731	106,143,465	141,873,266	13.66	10,386,037	4.19%	0	0.00%	10,386,037	**4.19%**
	Total	2,307,087,766			-2.4%	2,363,311,175	1,012,040,218	1,351,270,957	13.55	95,532,931	4.14%	4,184,183	0.18%	99,717,114	**4.32%**
	Total Nuclear Production Plant	3,662,915,955			-2.5%	3,752,875,519	1,686,050,712	2,066,824,807	12.48	158,341,636	4.32%	7,303,810	0.20%	165,645,446	**4.52%**
	HYDRAULIC PRODUCTION PLANT														
	Berrien Springs														
331.00	Structures & Improvements	696,548			-3.5%	720,698	341,708	378,990	13.34	26,600	3.82%	1,810	0.26%	28,410	**4.08%**
332.00	Reservoirs, Dams & Waterways	6,320,266			-3.5%	6,539,393	3,595,649	2,943,744	13.40	203,330	3.22%	16,353	0.26%	219,682	**3.48%**
333.00	Waterwheels, Turbines & Generators	8,386,954			-3.5%	8,677,735	4,422,138	4,255,597	13.21	300,137	3.58%	22,012	0.26%	322,150	**3.84%**
334.00	Accessory Electrical Equip.	1,417,718			-3.5%	1,466,871	780,602	686,269	13.04	48,859	3.45%	3,769	0.27%	52,628	**3.71%**
335.00	Misc. Power Plant Equip.	929,404			-3.5%	961,627	464,525	497,102	13.29	34,980	3.76%	2,425	0.26%	37,404	**4.02%**
	Total	17,750,890			-3.5%	18,366,324	9,604,622	8,761,702	13.27	613,905	3.46%	46,369	0.26%	660,274	**3.72%**
	Buchanan														
331.00	Structures & Improvements	660,195			-3.2%	681,575	327,996	353,579	13.34	24,902	3.77%	1,603	0.24%	26,505	**4.01%**
332.00	Reservoirs, Dams & Waterways	5,154,683			-3.2%	5,321,612	3,088,324	2,233,288	13.40	154,206	2.99%	12,457	0.24%	166,663	**3.23%**
333.00	Waterwheels, Turbines & Generators	1,414,445			-3.2%	1,460,250	868,658	591,592	13.21	41,316	2.92%	3,467	0.25%	44,784	**3.17%**
334.00	Accessory Electrical Equip.	1,108,771			-3.2%	1,144,677	652,643	492,034	13.04	34,979	3.15%	2,754	0.25%	37,733	**3.40%**
335.00	Misc. Power Plant Equip.	311,833			-3.2%	321,931	155,638	166,293	13.29	11,753	3.77%	760	0.24%	12,513	**4.01%**
	Total	8,649,927			-3.2%	8,930,046	5,093,259	3,836,787	13.31	267,157	3.09%	21,041	0.24%	288,198	**3.33%**
	Elkhart														
331.00	Structures & Improvements	1,632,902			-2.2%	1,669,104	955,341	713,763	7.42	91,315	5.59%	4,879	0.30%	96,195	**5.89%**
332.00	Reservoirs, Dams & Waterways	11,027,557			-2.2%	11,272,044	6,029,029	5,243,015	7.45	670,943	6.08%	32,817	0.30%	703,760	**6.38%**
333.00	Waterwheels, Turbines & Generators	875,459			-2.2%	894,868	564,389	330,479	7.35	42,322	4.83%	2,641	0.30%	44,963	**5.14%**
334.00	Accessory Electrical Equip.	766,670			-2.2%	783,667	490,812	292,855	7.27	37,945	4.95%	2,338	0.30%	40,283	**5.25%**

Depreciation Rate Development

Account No.	Description	[1] Plant 12/31/2020	[2] Iowa Curve Type	AL	[3] Net Salvage	[4] Depreciable Base	[5] Book Reserve	[6] Future Accruals	[7] Remaining Life	[8] Service Life Accrual	[9] Service Life Rate	[10] Net Salvage Accrual	[11] Net Salvage Rate	[12] Total Accrual	[13] Total Rate
335.00	Misc. Power Plant Equip.	342,337			-2.2%	349,927	167,864	182,063	7.39	23,609	6.90%	1,027	0.30%	24,636	**7.20%**
	Total	14,644,925			-2.2%	14,969,611	8,207,435	6,762,176	7.43	866,135	5.91%	43,702	0.30%	909,837	**6.21%**
	Twin Branch														
331.00	Structures & Improvements	1,428,784			-4.7%	1,496,113	611,137	884,976	13.34	61,293	4.29%	5,047	0.35%	66,340	**4.64%**
332.00	Reservoirs, Dams & Waterways	8,416,861			-4.7%	8,813,489	4,337,886	4,475,603	13.40	304,401	3.62%	29,599	0.35%	334,000	**3.97%**
333.00	Waterwheels, Turbines & Generators	9,909,128			-4.7%	10,376,076	4,812,145	5,563,931	13.21	385,843	3.89%	35,348	0.36%	421,191	**4.25%**
334.00	Accessory Electrical Equip.	2,876,083			-4.7%	3,011,613	1,440,344	1,571,269	13.04	110,103	3.83%	10,393	0.36%	120,496	**4.19%**
335.00	Misc. Power Plant Equip.	1,005,606			-4.7%	1,052,993	383,332	669,661	13.29	46,823	4.66%	3,566	0.35%	50,388	**5.01%**
	Total	23,636,462			-4.7%	24,750,284	11,584,844	13,165,440	13.27	908,462	3.84%	83,953	0.36%	992,416	**4.20%**
	Constantine														
331.00	Structures & Improvements	470,900			-9.1%	513,802	196,284	317,518	29.66	9,259	1.97%	1,446	0.31%	10,705	**2.27%**
332.00	Reservoirs, Dams & Waterways	1,653,789			-9.1%	1,804,460	725,426	1,079,034	29.99	30,956	1.87%	5,024	0.30%	35,980	**2.18%**
333.00	Waterwheels, Turbines & Generators	993,032			-9.1%	1,083,504	470,481	613,023	29.01	18,013	1.81%	3,119	0.31%	21,131	**2.13%**
334.00	Accessory Electrical Equip.	671,796			-9.1%	733,001	208,002	524,999	28.18	16,458	2.45%	2,172	0.32%	18,630	**2.77%**
335.00	Misc. Power Plant Equip.	475,641			-9.1%	518,975	125,344	393,631	29.43	11,903	2.50%	1,472	0.31%	13,375	**2.81%**
	Total	4,265,158			-9.1%	4,653,741	1,725,537	2,928,204	29.33	86,588	2.03%	13,233	0.31%	99,822	**2.34%**
	Mottville														
331.00	Structures & Improvements	797,060			-2.7%	818,859	444,018	374,841	10.40	33,946	4.26%	2,096	0.26%	36,042	**4.52%**
332.00	Reservoirs, Dams & Waterways	2,312,828			-2.7%	2,376,082	1,420,645	955,437	10.44	85,458	3.69%	6,059	0.26%	91,517	**3.96%**
333.00	Waterwheels, Turbines & Generators	639,576			-2.7%	657,068	409,772	247,296	10.32	22,268	3.48%	1,695	0.27%	23,963	**3.75%**
334.00	Accessory Electrical Equip.	772,571			-2.7%	793,700	443,543	350,157	10.22	32,195	4.17%	2,067	0.27%	34,262	**4.43%**
335.00	Misc. Power Plant Equip.	409,136			-2.7%	420,326	194,322	226,004	10.37	20,715	5.06%	1,079	0.26%	21,794	**5.33%**
336.00	Roads, Railroads & Bridges	902			-2.7%	927	643	284	10.38	25	2.77%	2	0.26%	27	**3.03%**
	Total	4,932,073			-2.7%	5,066,961	2,912,943	2,154,018	10.38	194,607	3.95%	12,999	0.26%	207,605	**4.21%**
	Crew Service Center														
331.00	Structures & Improvements	417,303			-4.6%	436,499	235,622	200,877	29.66	6,125	1.47%	647	0.16%	6,773	**1.62%**
335.00	Misc. Power Plant Equip.	126,865			-4.6%	132,701	72,600	60,101	29.43	1,844	1.45%	198	0.16%	2,042	**1.61%**
	Total	544,168			-4.6%	569,200	308,222	260,978	29.61	7,969	1.46%	846	0.16%	8,815	**1.62%**
	Total Hydraulic Production Plant	74,423,603			-3.9%	77,306,168	39,436,862	37,869,306	11.96	2,944,823	3.96%	222,143	0.30%	3,166,967	**4.26%**
	OTHER PRODUCTION PLANT														
	Deer Creek Solar Facility														
344.00	Generators	5,668,204			-2.0%	5,783,177	2,027,991	3,755,186	12.50	291,217	5.14%	9,198	0.16%	300,415	**5.30%**
345.00	Accessory Electric Equip.	720,502			-2.0%	735,116	150,340	584,776	12.50	45,613	6.33%	1,169	0.16%	46,782	**6.49%**
346.00	Misc. Power Plant Equip.	10,893			-2.0%	11,114	1,537	9,577	12.50	748	6.87%	18	0.16%	766	**7.03%**
	Total	6,399,599			-2.0%	6,529,407	2,179,868	4,349,539	12.50	337,578	5.27%	10,385	0.16%	347,963	**5.44%**
	Olive Solar Facility														
341.00	Structures & Improvements	376,687			-2.3%	385,176	116,803	268,373	13.50	19,251	5.11%	629	0.17%	19,880	**5.28%**
344.00	Generators	11,184,837			-2.3%	11,436,912	3,468,187	7,968,725	13.50	571,604	5.11%	18,672	0.17%	590,276	**5.28%**
345.00	Accessory Electric Equip.	269,062			-2.3%	275,126	83,431	191,695	13.50	13,750	5.11%	449	0.17%	14,200	**5.28%**
346.00	Misc. Power Plant Equip.	215,250			-2.3%	220,101	66,745	153,356	13.50	11,000	5.11%	359	0.17%	11,360	**5.28%**
	Total	12,045,836			-2.3%	12,317,316	3,735,166	8,582,150	13.50	615,605	5.11%	20,110	0.17%	635,715	**5.28%**
	Twin Branch Solar Facility														
344.00	Generators	6,955,324			-4.7%	7,283,080	2,177,641	5,105,439	13.50	353,902	5.09%	24,278	0.35%	378,181	**5.44%**

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Account No.	Description	Plant 12/31/2020	Iowa Curve Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Service Life Accrual	Service Life Rate	Net Salvage Accrual	Net Salvage Rate	Total Accrual	Total Rate
	Total	6,955,324			-4.7%	7,283,080	2,177,641	5,105,439	13.50	353,902	5.09%	24,278	0.35%	378,181	5.44%
	Watervliet Facility														
341.00	Structures & Improvements	358,237			-2.2%	366,136	111,082	255,054	13.50	18,308	5.11%	585	0.16%	18,893	5.27%
344.00	Generators	11,107,366			-2.2%	11,352,264	3,444,164	7,908,100	13.50	567,645	5.11%	18,141	0.16%	585,785	5.27%
346.00	Misc. Power Plant Equip.	343,931			-2.2%	351,514	106,416	245,098	13.50	17,594	5.12%	562	0.16%	18,155	5.28%
	Total	11,809,534			-2.2%	12,069,914	3,661,662	8,408,252	13.50	603,546	5.11%	19,287	0.16%	622,833	5.27%
	Total Other Production Plant	37,210,293			-2.7%	38,199,717	11,754,337	26,445,380	13.32	1,910,632	5.13%	74,060	0.20%	1,984,692	5.33%
	Total Production Plant	**4,712,321,073**			**-2.3%**	**4,821,752,130**	**2,200,081,937**	**2,621,670,193**	**10.02**	**251,213,423**	**5.33%**	**10,490,667**	**0.22%**	**261,704,090**	**5.55%**
	TRANSMISSION PLANT														
350.10	Land Rights	62,292,873	R5	65	0.0%	62,292,873	17,804,684	44,488,189	40.64	1,094,690	1.76%	0	0.00%	1,094,690	1.76%
352.00	Structures & Improvements	52,265,232	L1.5	65	-10.0%	57,491,755	5,985,346	51,506,409	56.13	824,512	1.58%	93,115	0.18%	917,627	1.76%
353.00	Station Equipment	826,489,176	L1	44	-10.0%	909,138,094	162,974,326	746,163,768	33.66	19,712,265	2.39%	2,455,405	0.30%	22,167,670	2.68%
354.00	Towers & Fixtures	230,452,983	R4	75	-39.0%	320,329,646	145,771,629	174,558,017	36.50	2,320,037	1.01%	2,462,374	1.07%	4,782,411	2.08%
355.00	Poles & Fixtures	208,136,265	L0.5	54	-64.0%	341,343,475	33,862,706	307,480,769	47.39	3,677,433	1.77%	2,810,872	1.35%	6,488,305	3.12%
356.00	OH Conductor & Devices	294,558,395	R4	67	-35.0%	397,653,833	121,734,305	275,919,528	40.10	4,309,828	1.46%	2,570,959	0.87%	6,880,786	2.34%
357.00	Underground Conduit	2,241,687	R5	55	0.0%	2,241,687	852,007	1,389,680	27.59	50,369	2.25%	0	0.00%	50,369	2.25%
358.00	Underground Conductor	4,522,363	L1.5	60	-13.0%	5,110,270	1,116,554	3,993,716	42.81	79,556	1.76%	13,733	0.30%	93,289	2.06%
359.00	Roads and Trails	91,159	R5	65	0.0%	91,159	19,768	71,391	46.51	1,535	1.68%	0	0.00%	1,535	1.68%
	Total Transmission Plant	**1,681,050,133**			**-24.7%**	**2,095,692,792**	**490,121,325**	**1,605,571,467**	**37.80**	**32,070,226**	**1.91%**	**10,406,457**	**0.62%**	**42,476,682**	2.53%
	DISTRIBUTION PLANT - INDIANA														
360.10	Land Rights	10,926,039	R5	65	0.0%	10,926,039	2,947,585	7,978,454	50.61	157,646	1.44%	0	0.00%	157,646	1.44%
361.00	Structures & Improvements	32,691,043	R1.5	65	-25.0%	40,863,804	3,066,234	37,797,570	58.94	502,627	1.54%	138,662	0.42%	641,289	1.96%
362.00	Station Equipment	379,401,090	L0.5	46	-12.0%	424,929,221	34,619,804	390,309,417	40.16	8,585,191	2.26%	1,133,669	0.30%	9,718,860	2.56%
363.00	Storage Battery Equipment	5,606,730	SQ	15	0.0%	5,606,730	3,747,078	1,859,652	3.65	509,494	9.09%	0	0.00%	509,494	9.09%
364.00	Poles, Towers, & Fixtures	252,111,755	L0	54	-87.0%	471,448,982	112,061,327	359,387,655	45.78	3,059,206	1.21%	4,791,115	1.90%	7,850,320	3.11%
365.00	Overhead Conductor & Devices	399,931,378	L0	48	-16.0%	463,920,398	90,991,491	372,928,907	41.31	7,478,574	1.87%	1,548,996	0.39%	9,027,570	2.26%
366.00	Underground Conduit	144,882,340	R2	71	0.0%	144,882,340	22,768,052	122,114,288	61.71	1,978,841	1.37%	0	0.00%	1,978,841	1.37%
367.00	Underground Conductor	255,708,978	R1	60	0.0%	255,708,978	43,352,417	212,356,561	50.28	4,223,480	1.65%	0	0.00%	4,223,480	1.65%
368.00	Line Transformers	318,204,324	R0.5	43	-8.0%	343,660,670	134,226,451	209,434,219	34.97	5,261,020	1.65%	727,948	0.23%	5,988,968	1.88%
369.00	Services	166,556,147	R0.5	56	-24.0%	206,529,622	60,380,012	146,149,610	44.95	2,362,094	1.42%	889,288	0.53%	3,251,382	1.95%
370.00	Meters	76,493,447	L0	16	-20.0%	91,792,136	40,860,844	50,931,292	11.35	3,139,436	4.10%	1,347,902	1.76%	4,487,339	5.87%
371.00	Installations on Custs. Prem.	20,434,795	L0	17	-23.0%	25,134,798	13,489,503	11,645,295	11.64	596,675	2.92%	403,780	1.98%	1,000,455	4.90%
373.00	Street Lighting & Signal Sys.	18,113,668	R0.5	22	-18.0%	21,374,128	12,452,701	8,921,427	13.12	431,476	2.38%	248,511	1.37%	679,987	3.75%
	Total Distribution Plant - Indiana	2,081,061,734			-20.5%	2,506,777,847	574,963,499	1,931,814,348	39.01	38,285,759	1.84%	11,229,870	0.54%	49,515,629	2.38%
	DISTRIBUTION PLANT - MICHIGAN														
360.10	Land Rights	6,056,743	R5	65	0.0%	6,056,743	1,692,786	4,363,957	50.61	86,227	1.42%	1,162	0.02%	87,389	1.44%
361.00	Structures & Improvements	4,510,462	R1.5	65	-25.0%	5,638,078	540,949	5,097,129	58.94	67,348	1.49%	21,132	0.47%	88,480	1.96%
362.00	Station Equipment	96,403,578	L0.5	46	-12.0%	107,972,007	10,609,243	97,362,764	40.16	2,136,313	2.22%	333,192	0.35%	2,469,505	2.56%
363.00	Storage Battery Equipment	0	SQ	15	0.0%		0		3.65						9.09%
364.00	Poles, Towers, & Fixtures	80,503,822	L0	54	-87.0%	150,542,147	43,312,615	107,229,532	45.78	812,390	1.01%	1,694,359	2.10%	2,506,749	3.11%
365.00	Overhead Conductor & Devices	139,323,640	L0	48	-16.0%	161,615,422	30,202,531	131,412,891	41.31	2,641,518	1.90%	503,406	0.36%	3,144,924	2.26%
366.00	Underground Conduit	12,573,950	R2	71	0.0%	12,573,950	2,977,885	9,596,065	61.71	155,503	1.24%	16,236	0.13%	171,738	1.37%
367.00	Underground Conductor	37,852,912	R1	60	0.0%	37,852,912	13,307,161	24,545,751	50.28	488,181	1.29%	137,026	0.36%	625,207	1.65%
368.00	Line Transformers	52,380,639	R0.5	43	-8.0%	56,571,090	22,569,130	34,001,960	34.97	852,488	1.63%	133,375	0.25%	985,863	1.88%
369.00	Services	33,052,679	R0.5	56	-24.0%	40,985,322	14,282,261	26,703,061	44.95	417,584	1.26%	227,645	0.69%	645,229	1.95%
370.00	Meters	22,239,359	L0	16	-20.0%	26,687,231	5,776,094	20,911,137	11.35	1,450,508	6.52%	-145,879	-0.66%	1,304,629	5.87%
371.00	Installations on Custs. Prem.	8,344,653	L0	17	-23.0%	10,263,923	6,412,292	3,851,631	11.64	166,010	1.99%	242,530	2.91%	408,541	4.90%
373.00	Street Lighting & Signal Sys.	5,882,009	R0.5	22	-18.0%	6,940,771	2,149,078	4,791,693	13.12	284,522	4.84%	-63,712	-1.08%	220,811	3.75%
	Total Distribution Plant - Michigan	499,124,446			-25.0%	623,699,596	153,832,025	469,867,571	37.12	9,558,593	1.92%	3,100,472	0.62%	12,659,065	2.54%

Depreciation Rate Development

Account No.	Description	[1] Plant 12/31/2020	[2] Iowa Curve Type	AL	[3] Net Salvage	[4] Depreciable Base	[5] Book Reserve	[6] Future Accruals	[7] Remaining Life	[8] Service Life Accrual	[9] Service Life Rate	[10] Net Salvage Accrual	[11] Net Salvage Rate	[12] Total Accrual	[13] Total Rate
	Total Distribution Plant	**2,580,186,180**			**-21.3%**	**3,130,477,443**	**728,795,524**	**2,401,681,919**	**38.63**	**47,844,352**	**1.85%**	**14,330,342**	**0.56%**	**62,174,694**	**2.41%**
	GENERAL PLANT														
390.00	Structures & Improvements	61,646,560	L1	45	-5.0%	64,728,888	9,451,468	55,277,420	35.28	1,479,453	2.40%	87,368	0.14%	1,566,820	**2.54%**
391.00	Office Furniture & Equipment	5,869,860	SQ	22	3.0%	5,693,764	1,640,513	4,053,251	12.62	335,131	5.71%	-13,954	-0.24%	321,177	**5.47%**
393.00	Stores Equipment	996,539	SQ	14	0.0%	996,539	193,264	803,275	9.98	80,488	8.08%	0	0.00%	80,488	**8.08%**
394.00	Tools Shop & Garage Equipment	16,780,302	SQ	16	0.0%	16,780,302	5,018,013	11,762,289	8.92	1,318,642	7.86%	0	0.00%	1,318,642	**7.86%**
395.00	Laboratory Equipment	240,988	SQ	20	1.0%	238,578	77,666	160,912	10.37	15,749	6.54%	-232	-0.10%	15,517	**6.44%**
396.00	Power Operated Equipment	543,715	SQ	25	0.0%	543,715	240,374	303,341	8.65	35,068	6.45%	0	0.00%	35,068	**6.45%**
397.00	Communication Equipment	66,159,303	SQ	27	-1.0%	66,820,896	12,559,966	54,260,930	19.49	2,750,094	4.16%	33,945	0.05%	2,784,040	**4.21%**
398.00	Miscellaneous Equipment	10,826,054	SQ	30	8.0%	9,959,970	2,727,867	7,232,103	17.84	453,934	4.19%	-48,547	-0.45%	405,387	**3.74%**
	Total General Plant	**163,063,321**			**-1.7%**	**165,762,652**	**31,909,131**	**133,853,521**	**20.51**	**6,468,560**	**3.97%**	**58,579**	**0.04%**	**6,527,140**	**4.00%**
	TOTAL DEPRECIABLE PLANT	**$ 9,136,620,707**			**-11.8%**	**$ 10,213,685,017**	**$ 3,450,907,917**	**$ 6,762,777,100**	**18.14**	**$ 337,596,561**	**3.69%**	**$ 35,286,045**	**0.39%**	**$ 372,882,606**	**4.08%**

[1] From depreciation study
[2] Average life and Iowa curve shape developed through statistical analysis and professional judgment
[3] Mass net salvage rates developed through statistical analysis and professional judgment; terminal net salvage rates for production units are from Attachment DJG-2-6
[4] = [1]*(1-[3])
[5] From depreciation study
[6] = [4] - [5]
[7] Composite remaining life based on Iowa cuve in [2]; see remaining life exhibit for detailed calculations
[8] = ([1] - [5]) / [7]
[9] = [8] / [1]
[10] = [12] - [8]
[11] = [13] - [9]
[12] = [6] / [7]
[13] = [12] / [1]

Terminal Net Salvage

[1] Production Units	[2] Plant Balance	[3] Terminal Net Salvage Est.	[4] Contingency Cost	[5] Net Salvage Less Contingency Costs	[6] Add Interim Net Salvage	[7] Adjusted Net Salvage	[8] Adjusted Net Salvage Rate
Rockport	$ 937,771,222	$ 8,203,638	$ -	$ 8,203,638	$ 7,395,867	$ 15,599,505	-1.7%
Berrien Springs	15,311,011	124,024	53,600	70,424	460,418	530,842	-3.5%
Buchanan	8,014,479	118,633	42,600	76,033	183,508	259,541	-3.2%
Constantine	4,809,486	258,723	67,700	191,023	247,152	438,175	-9.1%
Crew Service Center	544,168	-	-	-	25,032	25,032	-4.6%
Elkhart	9,378,445	48,005	20,000	28,005	179,920	207,925	-2.2%
Mottville	4,671,287	59,300	18,200	41,100	86,656	127,756	-2.7%
Twin Branch	14,258,629	85,247	40,000	45,247	626,663	671,910	-4.7%
Deer Creek	6,399,599	129,808	-	129,808		129,808	-2.0%
Olive	12,045,836	271,480	-	271,480		271,480	-2.3%
Twin Branch	6,955,324	185,680	-	185,680		185,680	-2.7%
Watervliet	11,809,534	260,380	-	260,380		260,380	-2.2%
Total		$ 9,744,918	$ 242,100	$ 9,502,818	$ 9,205,216	$ 18,708,034	

[1], [2] From depreciation study
[3], [4] From decommissioning studies
[5] = [4] - [3]
[6] Add interim net salvage from depreciation study
[7] = [5] + [6]
[8] = [7] / [2] * -1 ; does not include escalation or inflation of present value demolition costs

Account 367 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**I&M R2-54**	**OUCC R1-60**	**PSO SSD**	**OIEC SSD**
0.0	222,647,654	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	220,953,356	99.95%	99.91%	99.79%	0.0000	0.0000
1.5	204,857,949	99.73%	99.73%	99.35%	0.0000	0.0000
2.5	193,881,103	99.43%	99.53%	98.90%	0.0000	0.0000
3.5	176,999,094	99.13%	99.32%	98.44%	0.0000	0.0000
4.5	162,545,028	98.79%	99.10%	97.98%	0.0000	0.0001
5.5	149,300,422	98.49%	98.87%	97.50%	0.0000	0.0001
6.5	146,847,749	98.19%	98.62%	97.01%	0.0000	0.0001
7.5	145,481,719	97.85%	98.36%	96.51%	0.0000	0.0002
8.5	142,675,750	97.48%	98.08%	96.01%	0.0000	0.0002
9.5	138,845,260	96.99%	97.78%	95.49%	0.0001	0.0002
10.5	137,692,434	96.44%	97.47%	94.96%	0.0001	0.0002
11.5	134,141,692	95.87%	97.14%	94.42%	0.0002	0.0002
12.5	125,877,710	95.33%	96.79%	93.88%	0.0002	0.0002
13.5	117,773,178	94.77%	96.42%	93.32%	0.0003	0.0002
14.5	111,447,666	94.21%	96.04%	92.75%	0.0003	0.0002
15.5	102,699,357	93.65%	95.63%	92.18%	0.0004	0.0002
16.5	94,156,001	93.06%	95.20%	91.59%	0.0005	0.0002
17.5	87,299,333	92.43%	94.74%	90.99%	0.0005	0.0002
18.5	77,923,466	91.77%	94.27%	90.39%	0.0006	0.0002
19.5	72,946,972	91.10%	93.77%	89.77%	0.0007	0.0002
20.5	66,046,905	90.43%	93.24%	89.15%	0.0008	0.0002
21.5	60,877,465	89.73%	92.69%	88.52%	0.0009	0.0001
22.5	56,947,684	89.02%	92.11%	87.87%	0.0010	0.0001
23.5	51,523,190	88.33%	91.50%	87.22%	0.0010	0.0001
24.5	46,974,968	87.59%	90.86%	86.55%	0.0011	0.0001
25.5	44,431,757	86.79%	90.19%	85.87%	0.0012	0.0001
26.5	40,094,489	85.93%	89.49%	85.18%	0.0013	0.0001
27.5	35,994,788	85.06%	88.76%	84.48%	0.0014	0.0000
28.5	33,945,941	84.13%	87.99%	83.76%	0.0015	0.0000
29.5	29,715,554	83.16%	87.18%	83.04%	0.0016	0.0000
30.5	25,329,015	82.26%	86.34%	82.29%	0.0017	0.0000
31.5	22,556,851	81.35%	85.47%	81.53%	0.0017	0.0000
32.5	19,330,085	80.31%	84.55%	80.76%	0.0018	0.0000
33.5	16,463,369	79.46%	83.60%	79.98%	0.0017	0.0000
34.5	14,654,976	78.60%	82.60%	79.17%	0.0016	0.0000
35.5	13,357,203	77.70%	81.56%	78.35%	0.0015	0.0000
36.5	12,770,429	76.84%	80.48%	77.52%	0.0013	0.0000
37.5	11,847,094	75.94%	79.36%	76.67%	0.0012	0.0001
38.5	11,346,692	75.02%	78.19%	75.80%	0.0010	0.0001
39.5	10,242,948	74.12%	76.97%	74.91%	0.0008	0.0001
40.5	8,397,958	73.25%	75.71%	74.01%	0.0006	0.0001
41.5	7,195,394	72.42%	74.40%	73.08%	0.0004	0.0000
42.5	6,020,688	71.57%	73.04%	72.14%	0.0002	0.0000
43.5	5,387,622	70.66%	71.63%	71.19%	0.0001	0.0000
44.5	4,889,418	69.71%	70.17%	70.21%	0.0000	0.0000
45.5	4,302,636	68.68%	68.67%	69.22%	0.0000	0.0000
46.5	3,859,095	67.63%	67.12%	68.20%	0.0000	0.0000
47.5	2,920,417	66.59%	65.52%	67.18%	0.0001	0.0000

Account 367 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] I&M R2-54	[5] OUCC R1-60	[6] PSO SSD	[7] OIEC SSD
48.5	2,037,871	65.50%	63.87%	66.13%	0.0003	0.0000
49.5	1,627,553	64.37%	62.17%	65.06%	0.0005	0.0000
50.5	1,294,281	62.40%	60.43%	63.98%	0.0004	0.0002
51.5	947,142	60.38%	58.65%	62.88%	0.0003	0.0006
52.5	712,862	58.64%	56.83%	61.76%	0.0003	0.0010
53.5	493,342	57.10%	54.97%	60.63%	0.0005	0.0012
54.5	380,535	55.60%	53.07%	59.48%	0.0006	0.0015
55.5	345,881	54.68%	51.14%	58.31%	0.0012	0.0013
56.5	262,513	53.86%	49.19%	57.13%	0.0022	0.0011
57.5	244,394	52.93%	47.21%	55.94%	0.0033	0.0009
58.5	228,466	51.94%	45.21%	54.73%	0.0045	0.0008
59.5	214,373	50.84%	43.19%	53.51%	0.0058	0.0007
60.5	176,235	49.81%	41.17%	52.28%	0.0075	0.0006
61.5	83,640	48.24%	39.14%	51.03%	0.0083	0.0008
62.5	60,510	46.88%	37.12%	49.78%	0.0095	0.0008
63.5	44,383	45.84%	35.11%	48.51%	0.0115	0.0007
64.5	26,105	44.94%	33.11%	47.24%	0.0140	0.0005
65.5	18,564	44.12%	31.13%	45.95%	0.0169	0.0003
66.5	6,046	43.16%	29.18%	44.66%	0.0195	0.0002
67.5	3,606	42.38%	27.27%	43.37%	0.0228	0.0001
68.5	2,025	41.90%	25.39%	42.07%	0.0272	0.0000
69.5	1,062	41.40%	23.57%	40.77%	0.0318	0.0000
70.5	334	41.15%	21.80%	39.46%	0.0374	0.0003
71.5	322	39.74%	20.08%	38.16%	0.0387	0.0003
72.5	0	0.00%	18.43%	36.85%		
Sum of Squared Differences				[8]	0.2964	0.0188
Up to 1% of Beginning Exposures				[9]	0.0313	0.0046

[1] Age in years using half-year convention

[2] Dollars exposed to retirement at the beginning of each age interval

[3] Observed life table based on the Company's property records. These numbers form the original survivor curve.

[4] The Company's selected Iowa curve to be fitted to the OLT.

[5] My selected Iowa curve to be fitted to the OLT.

[6] = ([4] - [3])^2. This is the squared difference between each point on the Company's curve and the observed survivor curve.

[7] = ([5] - [3])^2. This is the squared difference between each point on my curve and the observed survivor curve.

[8] = Sum of squared differences. The smallest SSD represents the best mathematical fit.

Account 370 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] I&M SQ-15	[5] OUCC L0-16	[6] PSO SSD	[7] OIEC SSD
0.0	126,094,999	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	115,504,476	98.75%	100.00%	99.42%	0.0002	0.0000
1.5	113,147,318	96.00%	100.00%	97.35%	0.0016	0.0002
2.5	109,884,868	93.32%	100.00%	94.62%	0.0045	0.0002
3.5	105,942,373	90.08%	100.00%	91.47%	0.0098	0.0002
4.5	102,391,285	86.87%	100.00%	88.02%	0.0172	0.0001
5.5	99,060,998	83.75%	100.00%	84.36%	0.0264	0.0000
6.5	93,647,351	79.34%	100.00%	80.56%	0.0427	0.0001
7.5	87,963,017	75.37%	100.00%	76.69%	0.0607	0.0002
8.5	66,704,386	72.14%	100.00%	72.79%	0.0776	0.0000
9.5	59,727,732	69.08%	100.00%	68.90%	0.0956	0.0000
10.5	58,508,551	66.05%	100.00%	65.03%	0.1153	0.0001
11.5	55,388,082	62.90%	100.00%	61.20%	0.1376	0.0003
12.5	52,468,603	59.57%	100.00%	57.42%	0.1635	0.0005
13.5	49,041,314	56.46%	100.00%	53.71%	0.1896	0.0008
14.5	37,010,125	52.73%	100.00%	50.08%	0.2234	0.0007
15.5	34,335,284	48.89%	0.00%	46.55%	0.2390	0.0005
16.5	32,349,764	45.24%	0.00%	43.11%	0.2047	0.0005
17.5	31,093,882	41.78%	0.00%	39.79%	0.1746	0.0004
18.5	29,172,710	38.24%	0.00%	36.60%	0.1462	0.0003
19.5	26,528,695	34.95%	0.00%	33.53%	0.1222	0.0002
20.5	24,465,741	32.03%	0.00%	30.61%	0.1026	0.0002
21.5	21,972,560	29.10%	0.00%	27.83%	0.0847	0.0002
22.5	18,941,897	26.32%	0.00%	25.19%	0.0693	0.0001
23.5	16,262,618	23.57%	0.00%	22.71%	0.0556	0.0001
24.5	13,883,303	21.02%	0.00%	20.39%	0.0442	0.0000
25.5	11,768,001	18.87%	0.00%	18.22%	0.0356	0.0000
26.5	9,689,700	16.91%	0.00%	16.20%	0.0286	0.0001
27.5	7,949,176	15.27%	0.00%	14.34%	0.0233	0.0001
28.5	6,608,780	13.75%	0.00%	12.62%	0.0189	0.0001
29.5	5,430,213	12.48%	0.00%	11.05%	0.0156	0.0002
30.5	4,382,746	11.30%	0.00%	9.62%	0.0128	0.0003
31.5	3,382,465	10.16%	0.00%	8.33%	0.0103	0.0003
32.5	2,811,312	9.43%	0.00%	7.17%	0.0089	0.0005
33.5	2,273,168	8.80%	0.00%	6.13%	0.0077	0.0007
34.5	1,726,037	7.68%	0.00%	5.21%	0.0059	0.0006
35.5	1,449,726	7.37%	0.00%	4.39%	0.0054	0.0009
36.5	1,107,686	6.91%	0.00%	3.68%	0.0048	0.0010
37.5	762,713	5.71%	0.00%	3.05%	0.0033	0.0007
38.5	507,270	5.36%	0.00%	2.52%	0.0029	0.0008
39.5	366,641	5.02%	0.00%	2.06%	0.0025	0.0009
40.5	280,730	4.83%	0.00%	1.66%	0.0023	0.0010
41.5	182,070	4.54%	0.00%	1.33%	0.0021	0.0010
42.5	122,039	3.04%	0.00%	1.06%	0.0009	0.0004
43.5	121,941	3.04%	0.00%	0.83%	0.0009	0.0005
44.5	120,837	3.04%	0.00%	0.64%	0.0009	0.0006
45.5	113,290	2.92%	0.00%	0.49%	0.0009	0.0006
46.5	110,773	2.88%	0.00%	0.37%	0.0008	0.0006
47.5	91,569	2.84%	0.00%	0.28%	0.0008	0.0007
48.5	75,054	2.65%	0.00%	0.20%	0.0007	0.0006
49.5	75,724	2.65%	0.00%	0.15%	0.0007	0.0006
50.5	74,961	2.63%	0.00%	0.10%	0.0007	0.0006
51.5	59,488	2.61%	0.00%	0.07%	0.0007	0.0006
52.5	33,421	1.96%	0.00%	0.05%	0.0004	0.0004
53.5	32,763	1.92%	0.00%	0.03%	0.0004	0.0004
54.5	31,549	1.92%	0.00%	0.02%	0.0004	0.0004
55.5	31,150	1.92%	0.00%	0.01%	0.0004	0.0004

Account 370 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] I&M SQ-15	[5] OUCC L0-16	[6] PSO SSD	[7] OIEC SSD
56.5	27,540	1.71%	0.00%	0.01%	0.0003	0.0003
57.5	25,237	1.59%	0.00%	0.00%	0.0003	0.0003
58.5	19,537	1.47%	0.00%	0.00%	0.0002	0.0002
59.5	19,898	1.47%	0.00%	0.00%	0.0002	0.0002
60.5	19,158	1.40%	0.00%	0.00%	0.0002	0.0002
61.5	18,103	1.32%	0.00%	0.00%	0.0002	0.0002
62.5	16,426	1.30%	0.00%	0.00%	0.0002	0.0002
63.5	15,981	1.30%	0.00%	0.00%	0.0002	0.0002
64.5	15,957	1.30%	0.00%	0.00%	0.0002	0.0002
65.5	15,554	1.26%	0.00%	0.00%	0.0002	0.0002
66.5	15,260	1.26%	0.00%	0.00%	0.0002	0.0002
67.5	6,549	1.15%	0.00%	0.00%	0.0001	0.0001
68.5	3,398	0.81%	0.00%	0.00%	0.0001	0.0001
69.5	1,437	0.61%	0.00%	0.00%	0.0000	0.0000
70.5	1,524	0.46%	0.00%	0.00%	0.0000	0.0000
71.5	1,518	0.44%	0.00%	0.00%	0.0000	0.0000
72.5	1,327	0.39%	0.00%	0.00%	0.0000	0.0000
73.5	1,148	0.33%	0.00%	0.00%	0.0000	0.0000
74.5	1,148	0.33%	0.00%	0.00%	0.0000	0.0000
75.5	819	0.23%	0.00%	0.00%	0.0000	0.0000
76.5	618	0.18%	0.00%	0.00%	0.0000	0.0000
77.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
78.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
79.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
80.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
81.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
82.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
83.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
84.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
85.5	604	0.17%	0.00%	0.00%	0.0000	0.0000
86.5	92	0.03%	0.00%	0.00%	0.0000	0.0000
87.5	24	0.01%	0.00%	0.00%	0.0000	0.0000
88.5			0.00%	0.00%		
Sum of Squared Differences				[8]	2.6115	0.0250
Up to 1% of Beginning Exposures				[9]	2.6047	0.0186

[1] Age in years using half-year convention

[2] Dollars exposed to retirement at the beginning of each age interval

[3] Observed life table based on the Company's property records. These numbers form the original survivor curve.

[4] The Company's selected Iowa curve to be fitted to the OLT.

[5] My selected Iowa curve to be fitted to the OLT.

[6] = ([4] - [3])^2. This is the squared difference between each point on the Company's curve and the observed survivor curve.

[7] = ([5] - [3])^2. This is the squared difference between each point on my curve and the observed survivor curve.

[8] = Sum of squared differences. The smallest SSD represents the best mathematical fit.

Peer Group Life Comparison

			Peer Group					
		[1]	[2]	[3]	[4]	[5]	[6]	[7]
Acct	**Description**	**I&M**	**SWEPCO**	**OG&E**	**PSO**	**Peer Avg**	**Peer Avg Less I&M**	**OUCC**
	TRANSMISSION PLANT							
354	Towers & Fixtures	66	60	75	75	70	4	75
355	Poles & Fixtures	50	50	65	46	54	4	54
	DISTRIBUTION PLANT							
364	Poles, Towers, & Fixtures	41	55	55	53	54	13	54
365	OH Conductor & Devices	39	44	54	46	48	9	48
366	UG Conduit	60	70	65	78	71	11	71
368	Line Transformers	27	50	44	36	43	16	43
369	Services	44	55	53	60	56	12	56
	Average	**47**	**55**	**59**	**56**	**57**	**10**	**57**

[1] Company proposed average service lives from depreciation study

[2] Application of Southwestern Electric Power Company, Docket No. 46449, Order on Rehearing, pp. 33-34 (March 19, 2018).

[3] Final Order No. 662059, p. 8, Application of Oklahoma Gas and Electric Company, Docket No. PUD 201500273, Before the Corporation Commission of Oklahoma (March 20, 2017).

[4] Final Order No. 672864, pp. 5-6, Application of Public Service Company of Oklahoma, Docket No. PUD 201700151, Before the Corporation Commission of Oklahoma (January 31, 2018).

CERTIFICATE OF SERVICE

This is to certify that a copy of the Indiana Office of Utility Consumer Counselor's Testimony Filing has been served upon the following parties of record in the captioned proceeding by electronic service on October 12, 2021.

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